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VOLUME VII NUMBER 3

MADROÑO

A WEST AMERICAN JOURNAL OF BOTANY

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Published at North Queen Street and McGovern Avenue
Lancaster, Pennsylvania

July, 1943

MADROÑO

A WEST AMERICAN JOURNAL OF BOTANY

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Entered as second-class matter October 1, 1935, at the post office at Lancaster, Pa., under the act of March 3, 1879.

Established 1916. Published quarterly. Subscription Price $2.50 per year. Completed volumes I to V inclusive, $25.00; each volume $5.00; single numbers $0.75.

Papers up to 15 or 20 pages are acceptable. Longer contributions may be accepted if the excess costs of printing and illustration are borne by the contributor. Range extensions and similar notes will be published in condensed form with a suitable title under the general heading "Notes and News." Articles may be submitted to any member of the editorial board. Manuscripts may be included in the forthcoming issue provided that the contributor pay the cost of the pages added to the issue to accommodate his article. Reprints of any article are furnished at a cost of 4 pages, 50 copies $4.10; 100 copies $4.50; additional 100's $0.85; 8 pages, 50 copies $5.95; 100 copies $6.60; additional 100's $1.30; 16 pages, 50 copies $8.35; 100 copies $9.35; additional 100's $2.00. Covers, 50 for $2.75; additional covers at $1.65 per hundred. Reprints should be ordered when proofs are returned.

Published at North Queen Street and McGovern Avenue, Lancaster, Pennsylvania, for the

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Annual membership dues of the California Botanical Society are $2.50, $2.00 of which is for a year's subscription to Madroño. Dues should be remitted to the Treasurer. General correspondence and applications for membership should be addressed to the Secretary.

A NEW SPECIES OF TAUSCHIA FROM THE STATE OF WASHINGTON

Mildred E. Mathias and Lincoln Constance

Tauschia Hooveri sp. nov. Herba acaulescens, pseudoscapo e tubere globose, 10–14 cm. alta, omnino glabra glauca; folia in ambitu ovato-triangularia, petiolo excluso, 3–5 cm. longa, 1–6 cm. lata, pinnata vel partim bipinnata; foliola linearia, acuminata, 15–35 mm. longa, 1–2 mm. lata, integra, calloso-apiculata, marginibus reflexis; petioli 2–3 cm. longi; pedunculi graciles, 2–4 cm. longi; calycis dentes obsoleti; corollae albae; antherae purpureae; styli breves, filiformes, recurvati; carpophorum ad medium bifidum, ramis ad apicem approximatis; fructus linearioblongus ad apicem versus leviter attenuatus, 5–7 mm. longus, circa 2 mm. latus, glaucus, costis evidentibus filiformibus; vittae parvae solitariae in valleculis, 2 in commissura; semini facies fere plana.

Acaulescent with a pseudoscape 10–14 cm. high arising from a globose tuber; glabrous and glaucous throughout; leaves ovate-deltoid in general outline, excluding the petiole 3–5 cm. long, 4–6 cm. broad, pinnate to partially bipinnate, the leaflets linear, acuminate, 1.5–3.5 cm. long, 0.1–0.2 cm. broad, entire, callous-tipped, the margins reflexed; petioles 2–3 cm. long; peduncles slender, 2–4 cm. long; involucre and involucel wanting; fertile rays 3–7, stout, unequal, 2–10 mm. long; pedicels 1–3 mm. long; calyx teeth obsolete; flowers white, the anthers purple; styles short, filiform, recurved; carpophore 2-cleft about one-half way to the base, the halves approximate to the tip; fruit linear-oblong, tapering slightly at apex, 5–7 mm. long, about 2 mm. broad, glaucous, the ribs filiform but evident; oil tubes small, usually solitary in the intervals, 2 on the commissure; seed face nearly plane.

Type. "Near Cowiche, Yakima County, Washington," April 20, 1942, *Robert F. Hoover 5689* (University of California Herbarium no. 671873). There is one other collection, "Hills south of White Swan, Yakima County," March 24, 1942, *Hoover 5616* (Univ. Calif. Herb.). In a letter from the collector dated November 5, 1942, the following additional information is given: "In answer to your question about the habitat of *Tauschia Hooveri,* it grows in 'scablands,' in rather barren rocky clay, with *Artemisia rigida, Sisyrinchium Douglasii, Eriogonum thymoides, Viola trinervata,* etc."

To the best of our knowledge, this species has never been collected before, although the Yakima area has been rather intensively botanized previously by various collectors. It undoubtedly escaped notice because the plants were in ripe fruit



FIG. 1. *Tauschia Hooveri: a,* in anthesis, ×1; *b,* in fruit, ×1; *c,* side view of fruit, ×5; *d,* cross section of fruit, ×10.

before the end of April, and because in anthesis they so greatly simulate certain of the "bulbous" species of both *Lomatium* and the two species of *Orogenia.*

In a recent series of nomenclatorial transfers, the authors (Bull. Torrey Bot. Club 68: 121–124. 1941) proposed to reduce the monotypic genus *Hesperogenia* Coulter and Rose under *Tauschia* Schlecht. This step was not taken without some misgiving inasmuch as *Hesperogenia* is known only from Mount Rainier, Washington, and the geographically nearest undoubted *Tauschia* is not known to occur north of southwestern Oregon. In addition, the suborbicular fruit of *Hesperogenia* is unique in

Tauschia, although its other characters fit the latter genus very well. The discovery of *Tauschia Hooveri,* however, ends the supposed geographical isolation of *Hesperogenia* and appears to confirm the desirability of including it under *Tauschia.*

We are glad to have the opportunity to name this remarkable species for Dr. Hoover, whose critical collections and keen observations have been invaluable to us in our work with the Umbelliferae.

Department of Botany,
University of California, Berkeley,
November, 1942.

NOTES ON THE FLORA OF THE CHARLESTON MOUNTAINS, CLARK COUNTY, NEVADA
V. CACTACEAE

Ira W. Clokey

This treatment of the Cactaceae continues a series devoted to a study of the flora of the Charleston Mountains in southern Nevada and published as follows: Madroño 4: 128–130. 1937; Bull. So. Calif. Acad. Sci. 37: 1–11. 1938; *l.c.* 38: 1–7. 1939; and Madroño 6: 211–222. 1942. I wish to express my thanks to Dr. L. Benson, Dr. E. U. Clover, Mr. Fred Gibson and Dr. Ira L. Wiggins for assistance in the study of the Cactaceae of the Charleston Mountains and for specimens of and information regarding these and related species. Specimens of all of the species treated below except those of *Mammillaria tetrancistra* Engelm. have been widely distributed to the herbaria of the world. Types of the new species are all in the Clokey Herbarium now at the Bull. So. Calif. Acad. Sci. 37: 1–11. 1938; *l.c.* 38: 1–7. 1939; garding these and related species. Specimens of all the spe-University of California, Berkeley.

Key to the Genera of Cactaceae

Stems jointed, cylindrical or flat; leaves small, subulate, deciduous; areoles on tubercles or on flat surfaces, with numerous, barbed glochids; glochids and flowers produced from the same areoles; ovaries with areoles and glochids; spines barbed or not barbed ..... 1. *Opuntia*

Stems not jointed, cylindrical, without leaves; areoles on ridges or tubercles, without glochids; flowers produced above the areoles; ovaries with or without areoles, without glochids; spines not barbed.

Stems ribbed; spines borne on definite ridges.

Flowers borne above old spine-bearing areoles, solitary, appearing lateral, purple or crimson; tube and ovary spiny; fruit colored, thin-skinned, spiny ..... 2. *Echinocereus*

Flowers borne above young areoles, appearing sub-terminal in a circle near the top of plant; ovary scaly; fruit green, without spines ..... 3. *Echinocactus*

Stems not ribbed; spines borne on tubercles arranged in rows or scattered.

Flowers lateral; tubercles not grooved on upper side; one or more of the spines hooked; fruit red; seeds black, rugose, with a thick corky base in our species ..... 4. *Mammillaria*
Flowers terminal; tubercles grooved on upper side; none of the spines hooked; fruit green or rose, ripening slowly; seeds brown, pitted, without a thick corky base ..... 5. *Coryphantha*

Key to the Species of Opuntia Mill.

Joints cylindrical and tuberculate.
Spines smooth, covered with loose, hyaline sheaths.
Stem slender and solid, with a woody axis; tubercles flattened; spines solitary or absent ..... 1. *O. ramosissima*
Stems thick and fleshy with a reticulated, cylindrical axis; tubercles raised; spines more than one.
Tubercles two to three times as long as wide; fruit dry, with stout spines ..... 2. *O. acanthocarpa*
Tubercles less than twice as long as wide.
Plants erect, with one or few main stems; stems loosely branched; flowers yellow, tinged with red; fruit dry, with stiff spines on the upper areoles ..... 3. *O. echinocarpa*
Plants low, bushy, without a main stem; stems compactly short branched; flowers greenish-yellow; fruit somewhat fleshy, yellow, with a few delicate, deciduous spines .... 4. *O. multigeniculata*
Spines rough, without sheaths; plants prostrate .... 5. *O. Parishii*
Joints flattened, not tuberculate.
Joints spineless; flowers magenta; fruit dry, spineless ..... 6. *O. basilaris*
Joints spiny; flowers yellow.
Areoles 2–3 cm. apart; spines white or with brown base; fruit purple, juicy, spineless.
Fruit 3–3.5 cm. long, with green pulp; slopes above Griffith's mine at an elevation of 2450 meters ..... 7. *O. charlestonensis*
Fruit 4–6 cm. long, with purple pulp; at elevations of 1200–1350 meters ..... 8. *O. phaeacantha*
Areoles about 1 cm. apart; spines white (occasionally brownish); fruit dry, spiny.
Spines acicular, 3–5 cm. long and bristle-like, up to 12 cm. long ..... 9. *O. erinacea*
Spines all acicular, stiff, not over 2–3 cm. long .. 10. *O. polyacantha*

1. Opuntia ramosissima Engelm. Am. Jour. Sci. ser. 2, 14: 339. 1852.

Mohave and Colorado deserts, from California, Nevada and Arizona south to Sonora. Local habitat, widely scattered in sandy or gravelly soil in the Larrea Belt. Best developed in sandy soil east of Wilson's ranch where the plants are about one-half meter tall. Cottonwood Springs, altitude 1030 meters, *Clokey 8036;* E-Spear ranch, altitude 1640 meters, *Train 1743;* south of Indian Springs, altitude 1200 meters, *Clokey 8026;* east of Wilson's ranch, altitude 1100 meters, *Clokey 8437.* May to August.

2. Opuntia acanthocarpa Engelm. & Bigel. Proc. Am. Acad. 3: 308. 1856.

Mohave and Colorado deserts from California to southern Utah, south to Sonora. Local habitat, in sandy or gravelly soil in the Larrea Belt. Most abundant at Wilson's ranch. Wilson's ranch, altitude 1150 meters, *Clokey 8024, 8433.* June.

3. Opuntia echinocarpa Engelm. & Bigel. Proc. Am. Acad. 3: 305. 1856.

Mohave and Colorado deserts of California, east to Utah and Arizona, south to Lower California. Local habitat, local in the upper Larrea and lower Juniper belts. Most abundant in Kyle Canyon at an elevation of about 1600 meters. Kyle Canyon, *Clokey 7202, 8025.* June.

4. **Opuntia multigeniculata** Clokey sp. nov. E Sect. Cylindropuntia, humilis, subadscendens, habitu conferta, plus minusve 0.5 m. alta, ad 1.5 m. lata, ramorum ligno debili, reticulato; ramis majoribus depresso-tuberculatis, ca. 1.5–2 cm. crassis, geniculis lateralibus numerosis, 3–5 cm. longis, ca. 2 cm. crassis, tuberculis confertis 4–6 mm. longis, 2–3 mm. latis, 4–5 mm. altis, apice areola pallide brunneo-lanosa, 4–5 mm. longa, 2–2.5 mm. lata coronatis; aculeis ca. 12, geniculum ipsum fere occultantibus, delicatis, vaginis albidis barbulatis; aculeis centralibus 2–4, 15–18 cm. longis, lateralibus gracillimis; foliis teretibus apiculatis ca. 2 mm. longis; glochidiis ex areola summa albidis, 1.5 mm. longis; floribus in apice geniculi aggregatis, ca. 2.5 cm. longis totidemque latis; ovario conferte tuberculato, areolis prominentibus, ellipsoideis, lana pallide brunnea; aculeis paucis, pergracilibus, deciduis; perianthii laciniis pallide viridi-luteis, spatulatis, obtusis apiculatisve, 15–18 mm. longis; stylo cum stigmatibus luteis, stigmatum lobis 6–8; staminibus luteis; fructu globoso, luteo, subcarnoso, ca. 2 cm. longo, tuberculato, exaculeato, profunde umbilicato; hypanthii cavo pulpa incolora farcto; seminibus rotundatis, pallide luteis, haud nitidis, levibus, 2.5–3 mm. diametientibus, commissura brevi, lata, manifesta.

A low, semi-ascending, compact *Cylindropuntia,* 0.5 m. or less high, up to 1.5 m. wide, with stems having a weak, reticulated, woody framework; main stems low tuberculate, about 1.5–2 cm. thick, with crowded lateral joints 3–5 cm. long, about 2 cm. thick; lateral joints with closely placed tubercles, 4–6 mm. long, 2–3 mm. wide, 4–5 mm. high, with the entire upper end of the tubercle occupied by an areole 4–5 mm. long, 2–2.5 mm. wide, filled with light tan-colored wool; spines about 12, almost concealing the surface of the joints, delicate, white-sheathed, barbed; 2 to 4 central spines 15–18 mm. long; lateral spines very slender; leaves terete, apiculate, about 2 mm. long; glochids white, 1.5 mm. long, from the upper end of the areoles; flowers clustered at the tip

of the joints, about 2.5 cm. long and broad; ovary closely tuberculate; areoles prominent, oval, filled with light tan-colored wool; spines few, very delicate, deciduous; perianth-segments light greenish-yellow (Ridgway's Col. Stand. and Nom. plate 5, 25 YG–Y, b), spatulate, obtuse or apiculate, 15–18 mm. long; style and stigmas yellow; stigma lobes 6 to 8; stamens yellow; fruit globose, yellow, with somewhat fleshy walls, about 2 cm. high, tuberculate, spineless, deeply umbilicate; seed cavity filled with colorless jelly; seeds circular, light yellow, dull, smooth, 2.5–3 mm. in diameter; commissure short, broad, distinct.

Definitely known only from the type locality on an open, rocky ridge east of Wilson's ranch, Charleston Mountains, Clark County, Nevada, along road from Blue Diamond mill to the mine, at an elevation of 1400 meters; *Clokey 8430* (type), *8639, 8760.* Flower, May; fruit, July to September.

Mr. Fred Gibson of the Boyce Thompson Southwestern Arboretum states that plants similar to this are found near Prescott, at Congress, and along the Colorado River in Arizona. These have not been examined.

Opuntia multigeniculata is intermediate between the series Thurberianae and Echinocarpae. In the Echinocarpae it is closest to *O. echinocarpa* Engelm. & Bigel. It differs from this species in having weaker, less woody, shorter and more crowded stems. The fruit of *O. echinocarpa* is dry. The somewhat fleshy fruit and the seeds resemble *O. Whipplei* Engelm. & Bigel. The joints, however, are thicker, shorter, more crowded and more thickly armed than *O. Whipplei.* In the original description Engelmann and Bigelow (Proc. Am. Acad. 3: 307. 1856), state that the color of the flowers of *O. Whipplei* is red. Britton and Rose (Cact. 1: 55–56. 1919) and Benson and Thornber (Cact. Ariz. 36. 1940) give the color of the flowers as yellow.

Neither *O. echinocarpa* nor *O. Whipplei* grow near the type locality of *O. multigeniculata.*

5. Opuntia parishii Orcutt, West. Am. Sci. 10: 81. 1896.

Mohave Desert of California and southern Nevada. Local habitat, locally abundant in sand or gravelly soil in the Larrea Belt at elevations of 1000 to 1200 meters. Cottonwood Springs, *Clokey 8028;* south of Indian Springs, *Clokey 8027;* east of Wilson's ranch, *Clokey 8434.* June.

Drifting sand usually partially covers the old joints. This is a characteristic plant that could not be mistaken for any other *Cylindropuntia* in this region.

Explanation of the Figures, Plate 4.

Plate 4. Cactaceae of the Charleston Mountains, Nevada. Fig. A, *Opuntia multigeniculata* Clokey. Fig. B, *Opuntia acanthocarpa* Engelm. and Bigel. Fig. C, *Opuntia charlestonensis* Clokey.

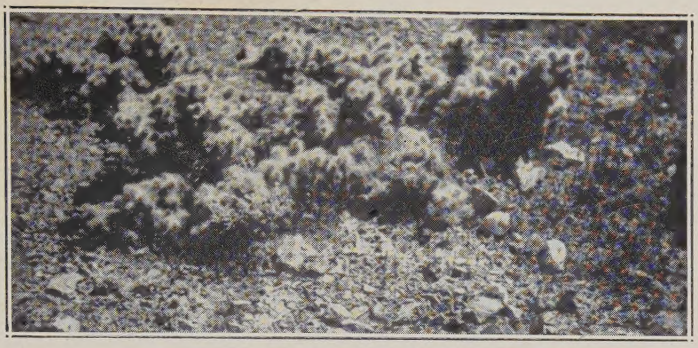


FIGURE A



FIGURE B



FIGURE C

PLATE 4. CACTACEAE OF THE CHARLESTON MOUNTAINS, NEVADA.

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6. Opuntia basilaris Engelm. & Bigel. Proc. Am. Acad. 3: 298. 1856.

Colorado and Mohave Deserts and surrounding mountains from California to Utah, south to Sonora. Local habitat, widely scattered in the Larrea Belt below 2000 meters. Clark Canyon, *Clokey & Anderson 7201;* southeast Indian Springs, *Train 1759;* Kyle Canyon, *Clokey 7205, 8032;* Trout Creek Canyon, *Clokey & Anderson 7206.* May.

7. **Opuntia charlestonensis** Clokey sp. nov. Humilis, patens ad 0.5 m. alta, 1.5 m. lata, ramis primo adscendentibus demum prostratis, tum geniculis 2–3 junioribus tantum suberectis; geniculis apicalibus vel lateralibus, ovalibus vel obovatis, saepius apice rotundatis, 10–18 cm. longis, 10–12 cm. latis, viridi-lutescentibus, primo vere rubentibus; areolis rotundatis vel ovatis, 5–6 mm. latis, 2–2.5 cm. distantibus; glochidiis 3–4 mm. longis, pallide brunneis in areolae apice; aculeis 4–6 acicularibus longitudine ludentibus, longissimis ad 4.5 cm., subcomplanatis tortisque, undique vertentibus, albidis vel albidis basi pallide brunneis; floribus primo laete luteis demum conferte roseis rubro-suffusis, 4–6 cm. longis, ca. 4 cm. latis; perianthii laciniis externis ovatis, acutis, mucronatis, internis ovatis, apice rotundatis saepius mucronatis; staminibus luteis; stylo cum stigmatibus luteis vel rubescentibus; fructu ellipsoideo 3–3.5 cm. longo, 1.5–2 cm. crasso, sordide purpurascente, cortice externo pulpaque viridibus; seminibus applanatis, 4–5 mm. diametientibus.

A low spreading plant up to 0.5 m. high, 1.5 m. wide, the main branches at first ascending, later prostrate with only the younger two to three joints ascending; joints arising from the faces as well as from the edges of older joints, oval or obovate, mostly rounded at tip, 10–18 cm. long, 10–12 cm. wide, yellowish-green, in the spring purplish; areoles circular or oval, 5–6 mm. across, 2–2.5 cm. apart; glochids in the upper part of the areoles, 3–4 mm. long, light brown; spines four to six, acicular, varying in length, the longest up to 4.5 cm. long, somewhat flattened and twisted, spreading in all directions, white or white with light brown base; flowers clear yellow at first, turning salmon tinged with red, 4–6 cm. long, about 4 cm. wide; outer perianth-segments ovate, acute, mucronate; inner segments ovate, rounded at tip, usually mucronate; stamens yellow; style and stigmas yellow or reddish tinged; fruit oval, 3–3.5 cm. long, 1.5–2 cm. thick, dull reddish-purple, with green rind and pulp; seeds flat, 4–5 mm. in diameter.

Known only from hillsides adjacent to Griffith's mine, associated with *Pinus monophylla* Torr. & Frém. and *P. scopulorum* (Engelm.) Lemmon, at an elevation of about 2450 meters, *Clokey 7203, 7592, 8029* (type), *8688, 8770.* Flower, July to August; fruit, September to October.

As suggested by Dr. Ira L. Wiggins, *O. charlestonensis* is most closely related to *O. megacarpa* Griffiths, a plant of the western edges of the Mohave and Colorado deserts in California. *O. megacarpa* has joints 20–30 cm. long, fruit 7–12 cm. long and seeds 7–8 mm. in diameter.

8. Opuntia phaeacantha Engelm. in Gray, Mem. Am. Acad. 4: 52. 1849.

Texas and Chihuahua to Arizona and the Charleston Mountains, Clark County, Nevada. Local habitat, among *Quercus, Fraxinus* and *Amelanchier* at Wilson's ranch and in open wash on gravelly soil at the mouth of Pine Canyon. Wilson's ranch, altitude 1180 meters, *Clokey 8031, 8424, 8431, 8761;* mouth of Pine Canyon, altitude 1350 meters, *Clokey 8656, 8685.* Flower, May to June; fruit, July to August.

The plants of *O. phaeacantha* Engelm. from the Charleston Mountains do not agree entirely with the original description but, except for the size of the fruit, fall well within the range included in that highly variable species by Britton and Rose (Cact. 1: 144. 1919), and Benson and Thornber (Cacti Ariz. 58. 1940). Boissevain and Davidson (Colo. Cacti. 12. 1940) give the size of the fruit as 4 to 6 centimeters in length, which agrees with the fruit of our plants. At Wilson's ranch, where the joints are up to 20 centimeters long, *O. phaeacantha* grows among *Quercus, Fraxinus* and *Amelanchier.* This protection may well account for the unusual size of the joints. The red color shown in winter and spring on the joints at Pine Canyon, but not at Wilson's ranch, is evidently due to cold. Cuttings from the Pine Canyon station grown in South Pasadena remain green throughout the winter.

9. Opuntia erinacea Engelm. Proc. Am. Acad. 3: 301. 1856.

Mohave Desert of California, east to Utah and Arizona. Local habitat, most abundant on a dry ridge east of Wilson's ranch along road from Blue Diamond mill to the mine, at an elevation of 1200 to 1400 meters. Mountain Springs, elevation 1700 meters, *Clokey 8423;* ridge east of Wilson's ranch, *Clokey 8033, 8436.* June to July.

10. Opuntia polyacantha Haworth, Suppl. Succ. 82. 1819.

North Dakota to Washington, south to Texas, Nevada and Arizona. Local habitat, occasional in the Juniper Belt. Harris Springs road, elevation 1800 meters, *Clokey 7591;* Lee Canyon, elevation 1800 meters, *Clokey 7204;* Willow Springs, elevation 1200 meters, *Clokey 8030.*

Key to the Species of Echinocereus Engelm.

Plants forming large clusters with many heads; spines few, white or gray, long and flexuous; flowers scarlet, funnelform ..... 1. *E. mohavensis*

Plants with few heads, ascending; spines white to brown, stout, curved; flowers purple, broad ..... 2. *E. Engelmannii*

1. Echinocereus mohavensis (Engelm. & Bigel.) Rümpler, Först. Handb. Cact. 2: 803. 1885.

Cereus mohavensis Engelm. & Bigel. in Engelm. Am. Acad. Arts and Sci. Proc. 3: 281. 1856.

Southeastern California to southern Utah, northern Arizona and south to Mexico. Local habitat, occasional as single plants in the Juniper Belt extending in places to the Pinyon and Yellow Pine belts. Grows in gravelly soil and on rock ledges. Cathedral Rock, elevation 2425 meters, *Clokey 7211;* Clark Canyon, elevation 1800 meters, *Clokey & Anderson 7200;* Charleston Park, elevation 2300 meters, *Clokey 8034,* elevation 8000 feet, *Alexander 755;* Kyle Canyon, elevation 2425 meters, *Clokey 7210,* elevation 1700 to 2400 meters, *Clokey 8435;* Lee Canyon, elevation 2670 meters, *Clokey, Clokey & Baker 7597.* May, June.

2. Echinocereus Engelmannii (Parry) Rümpler, Först. Handb. Cact. 2: 805. 1885.

Cereus Engelmannii Parry ex Engelm. Am. Jour. Sci. ser. 2, 14: 338. 1852.

Mohave and Colorado deserts of California, east to Utah and Arizona, south to Mexico. Local habitat, widely scattered in the Larrea and lower Juniper belts at elevations up to 1400 meters. Kyle Canyon, *Clokey 7590;* Trout Creek Fan, *Clokey 7207.*

Key to the Species of Echinocactus Mill.

Spines stout, flattened, annulate; flowers yellow.	
Stems globose, aggregate; axils of scales of ovary and fruit woolly	1. *E. polycephalus*
Stems simple, globose to cylindrical; axils of scales on ovary and fruit not woolly	2. *E. acanthodes*
Spines subulate, not annulate; scales on ovary and fruit few, without wool in the axils; flowers amaranth purple (Ridgway) to pink	3. *E. Johnsonii*

1. Echinocactus polycephalus Engelm. & Bigel. Proc. Am. Acad. 3: 276. 1856.

Eastern Mohave Desert of California, east to Utah and Arizona, south to northern Sonora. Local habitat, sparsely scattered in gravelly soil or on rock ledges in the Larrea Belt. South of Indian Springs, elevation 1300 meters, *Clokey 7598,* elevation 1250 meters, *Clokey 8432.* July.

2. Echinocactus acanthodes Lemaire, Cact. Gen. Nov. Sp. 106. 1839.

Ferocactus acanthodes (Lemaire) Britton & Rose, Cact. 3: 129. 1922.

Southern California to southern Nevada, Arizona and Lower California. Local habitat, on gravelly hills and rock ledges in the Larrea Belt at elevations of 1100 to 1400 meters. Most abundant on a ridge east of Wilson's ranch along road from Blue

Diamond mill to the mine. South of Indian Springs, *Clokey 7212, 7593;* rocky ridge east of Wilson's ranch, *Clokey 8428, 8429.*

3. Echinocactus Johnsonii Parry in Engelm. Bot. King's Geol. Expl. 40th Par. 5: 117. 1871.

Ferocactus Johnsonii (Parry), Britt. & Rose, Cact. 3: 141. 1922.

Southwestern Utah, northwestern Arizona, southern Nevada and extreme eastern Inyo County, California. Although *Echinocactus Johnsonii* so far has not been found in the Charleston Mountains it is to be expected since it occurs both to the east and to the west of the range. It occurs very locally on hot, steep, gravelly slopes in the Larrea Belt and should be looked for on the lowest foothills. East of the range: Frenchman's mine, 7 miles east of Las Vegas, elevation 630 meters, *Clokey 5900;* ridge south of Logandale, Clark County, elevation 550 meters, *Clokey 5901.* West of the range the type locality of *Echinocactus Johnsonii* Parry var. *octocentrus* Coult. is in the mountains east of Resting Springs, Inyo County, California.

The number of central spines is rather indefinite and variable even on the same plant. The spines graduate in thickness and length from the largest centrals to the shortest laterals so that there is no satisfactory line of demarcation.

Mammillaria Haw.

1. Mammillaria tetrancistra Engelm. Am. Jour. Sci. ser. 2, 14: 337. 1852.

Phellosperma tetrancistra (Engelm.) Britt. & Rose, Cact. 4: 60. 1923.

Southern Utah to Nevada, Arizona and southeastern California. Infrequent and isolated. Local habitat, known in the Charleston Mountains from a single specimen collected on a gravelly hillside in the Larrea Belt south of Indian Springs at an elevation of 1250 meters, *Clokey 8037* (Clokey Herbarium).

Key to the Species of Coryphantha (Engelm.) Lemaire

Flowers 2–3 cm. long, straw-colored with pinkish midrib to tinged with pink throughout; fruit green; seeds brown; Larrea and Juniper belts ..... 1. *C. deserti*

Flowers 3.5–4.5 cm. long, eugenia red to old rose (Ridgway); fruit more or less rose-colored; seeds reddish-brown; associated with *Pinus monophylla* Torr. & Frem., *P. scopulorum* (Engelm.) Lemmon and *Cercocarpus ledifolius* Nutt. ..... 2. *C. rosea*

Explanation of the Figures, Plate 5.

Plate 5. Cactaceae of the Charleston Mountains, Nevada. Figs. a, b, *Opuntia acanthocarpa* Engelm. and Bigel. Figs. c, d, *Opuntia echinocarpa* Engelm. and Bigel. Figs. e, f, g, *Opuntia multigeniculata* Clokey. Fig. h, *Opuntia echinocarpa* Engelm. and Bigel. Fig. i, *Coryphantha rosea* Clokey.

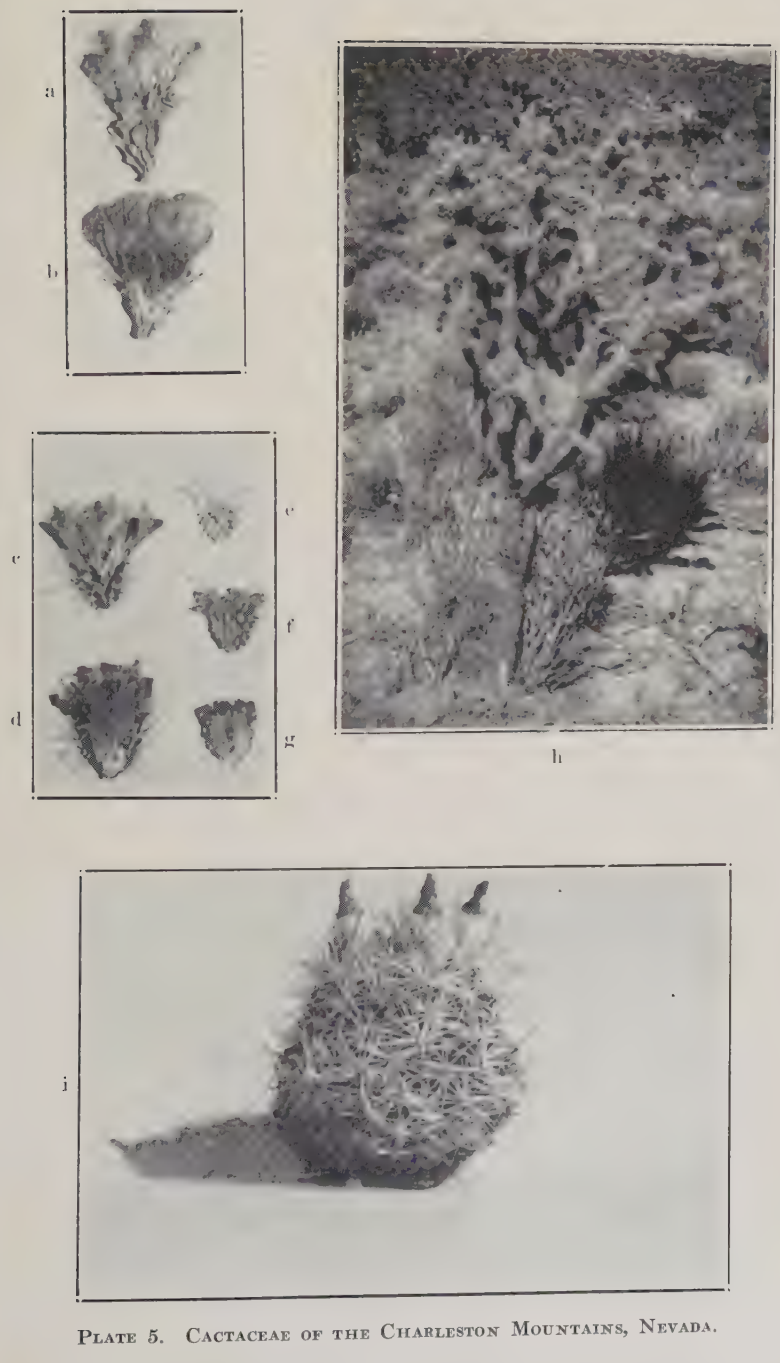


PLATE 5. CACTACEAE OF THE CHARLESTON MOUNTAINS, NEVADA.

1. Coryphantha deserti (Engelm.) Britt. & Rose, Cact. 4: 46. 1923.

Mammillaria deserti Engelm. Bot. Calif. 2: 449. 1880.

Eastern Mohave Desert of California to southern Nevada and possibly northwestern Arizona. Local habitat, widely scattered on gravelly hills and in washes in the Larrea and lower Juniper belts at elevations of 1100 to 1900 meters. It is most abundant in the wash below Rocky Gap Springs. The flowers, which last several days, are open only in the afternoons. Harris Springs road, *Clokey 7794;* Kyle Canyon at mouth, *Clokey 7594;* Kyle Canyon at junction of Harris Springs road, *Clokey 8425, 8426;* Rocky Gap Springs, *Clokey 8718.*

Jepson (Fl. Calif. 2: 550. 1936) regards *C. deserti* as a synonym of *C. chlorantha* (Engelm.) Britt. & Rose and reports the flower color as yellow or stramineous. *C. chlorantha* (*Mammillaria chlorantha* Engelm. in Rothr. Bot. Wheeler 127. 1878) was originally described as having yellow or greenish-yellow flowers and white stigma lobes. Engelmann described the petals of *M. deserti* (Bot. Calif. 2: 449. 1880) as light straw color turning to purplish at tips. On the examination of the flowers of hundreds of plants in the Charleston Mountains and over 300 dried flowers the writer failed to find a single flower without a distinct pink tinge at least on the midrib of the perianth-segments. This pink color was not confined to the tips but extended throughout the length of the petals. The flowers are 2.5–3 cm. long; the stigma lobes are yellow or partially tinged with pink. Several collections of *C. deserti* in 1942 by J. P. Hester from southern Clark County, Nevada, and eastern San Bernardino County, California, one of the latter from near to or possibly from the type locality, are excellent matches for the Charleston Mountains plants. *F. W. Gould 1589* and *Hester Utah 1,* both from the Beaverdam Mountains west of St. George, Utah, from near the type locality, agree with the original description of *C. chlorantha.* The flowers are 3.5–4 cm. long, the petals are yellow or greenish-yellow without a trace of pink, the stigma lobes are yellowish. Hester reports that the flowers of *C. chlorantha* are fragrant while those of *C. deserti* are not. From the study of this material it is evident that *C. deserti* should not be considered even as a variety of *C. chlorantha.*

2. **Coryphantha rosea** Clokey sp. nov. Globosa vel ovata, 4–15 cm. alta, 4–10 cm. crassa, tota aculeis dense tecta; tuberculis cylindricis, 10–15 mm. longis, supra totis sulcatis, sulcis areolisque tenellis albido-lanosis; aculeis 28–35 acicularibus, centrali semper angulo recto insidente, 5–10 mm. longis, saepius apice rubentibus (raro nigricantibus), centrali in lateralibus aculeis colore crassitudine intermediis sensim transeunte; floribus in axillis tuberculorum ad plantae ipsius apicem rubris vel roseis, 3.5–4.5 cm. longis, squamis tubi laciniisque externis e basi angus-

tatis, acuminatis, longe fimbriatis; laciniis internis similibus neque fimbriatis; filamentis luteis; stylo cum stigmatibus luteis vel roseis, stigmatis lobis linearibus; fructu ovoideo, praesucculento, perianthii reliquiis siccis persistentibus, tarde maturante, plus minusve rubro-colorato, 2–2.5 cm. longo, 1.2–1.4 cm. crasso; semine rubro-brunneo, foveolato, 2 mm. longo, 1.25 mm. crasso.

Globular to oval, simple, 4–15 cm. high, 4–10 cm. thick; armament dense, hiding the surface of the plant; tubercles cylindric, 10–15 mm. long, grooved through the length on the upper side, with tufts of white wool in the axils and areoles of the younger tubercles; spines 28 to 35, acicular, central permanently at right angles to the surface of the plant, 5–10 mm. long, more or less tipped with reddish-brown (rarely black), the central spines grading in thickness and depth of color to the laterals, on the upper, younger tubercles the spines are nearly erect, with age the spines lose their color and radiate almost at right angles to the tubercles; flowers borne in the axils of the young spiny tubercles forming a circle at the top of the plant, eugenia red to old rose (Ridgway's Color Stand. and Nom. plate XIII, I′ red), 3.5–4.5 cm. long; scales on the tube and outer perianth-segments tapering from the base, acuminate, long fimbriate; inner perianth segments similar but not fimbriate; filaments yellow; style and stigmas yellow or rose; stigma-lobes linear; fruit oval, very juicy, with the withered perianth persisting, ripening slowly, more or less colored with eugenia red or old rose, 2–2.5 cm. long, 1.2–1.4 cm. thick; seeds reddish-brown, pitted, 2 mm. long, 1.25 mm. wide.

Widely but sparsely scattered. Cold Creek, with *Juniperus utahensis* (Engelm.) Lemmon at 1850 meters, *Clokey 8035;* ridge south of Deer Creek, with *Cercocarpus ledifolius* Nutt. at 2650 meters, *Clokey 7595, 7596;* ridge along Lee Canyon with *Juniperus utahensis* (Engelm.) Lemmon at 1900 meters, *Clokey 7209;* Kyle Canyon to Deer Creek with *C. ledifolius* and *Pinus monophylla* Torr. & Frém. at 2400 meters, *Clokey 7208, 8038* (type); Kyle Canyon with *Pinus scopulorum* (Engelm.) Lemmon at 2200 meters, fruit ripe, *Clokey 8769.* Flower, June; fruit, September, October.

Coryphantha rosea is quite similar to *C. deserti* and *C. chlorantha* (Engelm.) Britt. and Rose in the appearance of the armament and in the shape and ciliation of the perianth-segments. It differs from *C. chlorantha* in the color of the flowers and fruit and from *C. deserti* in the size and color of the flowers and in the color of the fruit. It grows at higher elevations than *C. chlorantha* and *C. deserti* and, so far as known, is confined to the middle elevations of the Charleston Mountains. No intermediate plants have been found. *C. Alversonii* (Coult.) Orcutt, a plant growing at lower elevations in extreme southeastern California, has darker, heavier spines and is reported to have white stigma-lobes and green fruit.

South Pasadena, California,
April, 1942.

NOTEWORTHY PLANTS FROM IDAHO. II

Arthur Cronquist

During the summer of 1941 Mrs. Cronquist and I spent two months collecting plants in central Idaho. A complete set is deposited at the Missouri Botanical Garden, and nearly complete sets at the Gray Herbarium and the University of Idaho, Southern Branch; partial sets are deposited at the University of Minnesota and the Utah State Agricultural College. Several collections represent plants not previously known to occur in the state; a few are apparently undescribed. In the following discussion, unless otherwise indicated, the collection numbers are my own.

There are in Idaho at least two entities that have commonly been referred to *Melica bulbosa* Geyer ex Port. and Coult. One, the usual form of the species, is single-stemmed or loosely cespitose, with obvious bulbs at the bases of the culms. The other is very densely cespitose, growing in large tufts, with the bases of the culms only slightly if at all bulbous. Although the degree of bulbousness of the culms is known to be a variable character in *M. bulbosa,* the appearance of the cespitose form is so striking that in the field it might well be taken for a different species. The clumps are very dense, and difficult to separate into specimens suitable for herbarium sheets. It may be significant that in 1899 Aven Nelson considered the habit of specimens he collected so remarkable that he noted on the labels sent out with them, "in dense tufts with matted roots." Dr. W. S. Boyle, of the University of California, who is making a cytogenetic study of the genus, writes me that the cespitose plants I sent him do not differ sufficiently from the usual form to warrant separate treatment. Since the two forms are decidedly different in appearance, and are readily distinguishable in the field, I prefer to regard them as two varieties of one species.

Melica bulbosa Geyer var. **typica** nom. nov. *M. bulbosa* Geyer ex Port. and Coult. Syn. Fl. Colo. 149. 1874.

Melica bulbosa Geyer var. **caespitosa** var. nov. Planta caespitosa culmis ad basim haud vel vix bulbosis, cetera similis var. typicae.

Type. Open rocky granitic slope above west side of Alturas Lake, Blaine County, Idaho, altitude 7200 feet, June 22, 1941, *2603* (Missouri Botanical Garden; isotypes, Utah State Agricultural College, University of Idaho, Southern Branch). Cotypes. Idaho. Hillside above Mill Creek, 12 miles west of Challis, Custer County, altitude 7800 feet, July 8, 1941, *2977;* granitic outcrop above Wildhorse Creek, 25 miles southwest of Chilly, Custer County, altitude 7900 feet, July 23, 1941, *3354.* Wyoming. Teton Mountains, Uintah County, August 16, 1899, *Nelson* and *Nelson 6540.*

Sitanion Hanseni × Agropyron spicatum. On a rocky granitic hillside above Bull Trout Lake, Boise County, 35 miles west of Stanley at an altitude of 7000 feet, a colony of highly variable hordeaceous grasses was observed. A few spikes of the extreme of the robust plants were taken with the other plants of the same number (*3615*). A mile upstream and 200 feet higher on the same hillside, specimens of *Agropyron spicatum* (Pursh) Scribn. and Smith were seen and collected (*3635*). On examining my number *3615* in the herbarium, I find that the large spikes are quite uniform and represent *Sitanion Hanseni* (Scribn.) J. G. Smith. Other specimens of this number are so extremely variable as to be abnormal, transcending the differences between *Sitanion* and *Agropyron*. Spikes with all the spikelets solitary and with all the spikelets paired at the nodes occur on the same plant. One culm branches at the summit into two variable spikes. Tests made on a few rachises indicate that they disarticulate, but only on considerable urging. Individual portions of some of the spikes are strongly reminiscent of *Agropyron spicatum*. It is my opinion that the specimens represent a natural hybrid between *Sitanion Hanseni* and *Agropyron spicatum*.

Carex obovoidea sp. nov. Planta caespitosa, culmi 20–40 cm. alti, vaginae ventralitèr rubro-maculatae, ad apices rubiginosae, inferae aphyllae; spiculae plures androgynae, coarctatae in capitulum 15–30 mm. longum, 8–20 mm. latum; squamae late ovatae, castaneae, marginalibus perspicuae; utriculi 3–3.5 mm. longi, 1 mm. lati, plerumque attenuatis ab basibus spongiosi-turgidus, dorsaliter paucinervosi, ventraliter enervosi; achaenium obovatum, haud vel vix stipitatum, 1.5 mm. longum, minus quam 1 mm. latum; stigmata 2.

Caespitose, 20–40 cm. high, aphyllopodic; sheaths red-dotted ventrally and copper tinged at the mouths; spikes small, numerous in an ovoid or oblong head 15–30 mm. long, 8–20 mm. wide, sometimes slightly interrupted below, androgynous; scales broadly ovate, brown, with conspicuous hyaline margins; perigynium corky-thickened at the base, yellowish brown, changing to green upwards, or somewhat green-margined, 3–3.5 mm. long, 1 mm. wide, tapering from base to apex, or a little more strongly narrowed near the middle, prominently few-nerved dorsally, nerveless ventrally, margins serrulate, beak obliquely cut and dark brown at the tip; achene lenticular, obovate, broadest above the middle, scarcely stipitate, 1.5 mm. long, less than 1 mm. wide; stigmas 2.

Type. Mossy rocky meadow along tiny spring above Beaver Creek, near Marsh Creek, 25 miles northwest of Stanley, Custer County, Idaho, altitude 6500 feet, July 3, 1941, *2872* (Missouri Botanical Garden; isotypes at University of Idaho, Southern Branch and Utah State Agricultural College).

This species is a member of the small section *Vulpinae,* as treated by Mackenzie (1). It differs from the related *C. neurophora* Mack. and *C. nervina* Bailey in having the perigynia ventrally nerveless, and the sheaths ventrally red-dotted and copper-colored at the mouths. It differs from *C. Cusickii* Mack., of the related section *Paniculatae,* in its shorter stature, more contracted inflorescence, spongy-thickened perigynium-base, and tapering rather than abruptly contracted perigynium. It differs from all of these in its obovate achenes.

Astragalus reclinatus sp. nov. Planta perennis prostrata, caulibus 1 mm. crassis ad 50 cm. longis plus minusve strigosis; folia similiter strigosa foliolis 1–5 (plerumque 3) foliolo extremo 20–30 mm. longo, 3–5 mm. lato, eis lateralibus reductis vel defectis, stipulae virides parvulae 2–3 mm. longae, flores albidi-purpurei 12 mm. longi alis rostrum superantibus calyce 6 mm. longo, fructus sessilis 15–17 mm. longus, 3–4 mm. latus albido-strigosus suturis prominentibus haud intrusis.

Stems several from a perennial tap root, prostrate, spreading, up to 50 cm. long or more, about 1 mm. thick, green, striate, more or less pubescent with thick, short, nearly or quite basifixed hairs; leaves similarly pubescent, scattered, short-petiolate, with 1–5 (commonly 3) linear to narrowly lanceolate leaflets, the terminal one enlarged, mostly 20–30 mm. long and 3–5 mm. wide, tapering and acute at both ends, the lateral ones commonly somewhat reduced, mostly 10–20 mm. long and 1–3 mm. wide, sometimes absent; stipules tiny, green, triangular or ovate, free, 2–3 mm. long; flowers whitish, with a trace of purple, mostly 2–10 in short racemes; banner 12 mm. long, abruptly bent nearly at right angles 5 mm. from the base, the expanded portion 9 mm. long, 8 mm. wide and suborbicular when spread out; wings about 4 mm. wide and 11 mm. long, including the 5 mm. claw; keel 9 mm. long, 4 mm. high at the end, blunt; calyx with short black and white hairs intermingled in varying proportions, the tube 3.5–4 mm. long, the teeth triangular and about 2 mm. long; pod sessile, 1-celled, mostly 15–17 mm. long and 3–4 mm. wide, little-compressed, closely strigose with short white hairs, sutures prominent and not at all intruded.

Type. Moist alkaline bottoms along roadside two miles south of Dickey, Custer County, Idaho, altitude 6300 feet, July 14, 1941, *3086* (University of Minnesota; isotypes at Missouri Botanical Garden, Utah State Agricultural College and University of Idaho, Southern Branch).

This species of the section *Homalobus* is related to *A. flexuosus* Dougl. ex G. Don and the polymorphic *A. decumbens* (Nutt. ex T. & G.) Gray. The latter is common in the general area from which the type of *A. reclinatus* was taken, but was not seen in the immediate vicinity, nor have I ever seen it in the same type of

habitat. *A. flexuosus,* predominantly a species of the great plains, is not known to occur in Idaho.

The most conspicuous difference between *A. reclinatus* and its close relatives is its prostrate habit. Probably more important is the type of leaf. In *A. flexuosus* the lateral leaflets are several to numerous and well developed. The leaves of *A. decumbens* are highly variable, the leaflets often being in part reduced to phyllodia, but the terminal leaflet is affected as much as the others, and variation in that direction connects the species with the closely related *A. diversifolius* Gray, a rush-like plant in which the leaves are reduced to naked or nearly naked narrow rachises. In *A. reclinatus* the tendency is for the terminal leaflet to be enlarged at the expense of the others. None of the leaves on my specimens have more than five leaflets, and some are quite simple.

The flower, although superficially resembling that of the larger-flowered types of *A. decumbens* (*"A. hylophilus"* for example), shows its own distinctive differences. In *A. decumbens* the wings scarcely surpass the keel; in *A. reclinatus* the wings obviously surpass the keel, though not so prominently as in *A. flexuosus.* The upward widening of the pods commonly found in *A. decumbens* is inconspicuous or absent in *A. reclinatus.* The cross section of the pod is less compressed than in *A. decumbens,* and a little more so than in *A. flexuosus.* The stipules in *A. reclinatus* are tiny and green; in *A. flexuosus* and *A. decumbens* they are larger, mostly 5 mm. long or more, and somewhat scarious.

Although *A. reclinatus* is represented by only one collection, its distinguishing features, extending from technical characters of the flower to leaf type and habit, are so pronounced that I see little room for doubt as to the validity of the species.

Gentiana calycosa Griseb. subsp. asepala Maguire. Madroño 6: 151. 1942. *G. idahoensis* Gandoger, Bull. Bot. Soc. Fr. 65: 60. 1918.

This recently described entity is represented in my collections by the following numbers: *3640, 3681, 3756,* and *3757.* Prior to the publication of Maguire's paper (2), this material had been identified as *G. idahoensis* Gandoger, the type of which was collected by Evermann at Pettit Lake, Blaine County, Idaho. At that time I doubted that it was more than subspecifically distinct from *G. calycosa.* It is now evident that *G. idahoensis* should be added to the synonymy of *G. calycosa* subsp. *asepala.*

Agastache Cusickii (Greenm.) Heller was described from the Steens Mountains, Oregon, and is known to Peck (3) only from the Steens Mountains. An isotype is in the University of Minnesota herbarium. A small *Agastache* collected in Custer County, Idaho, closely resembles *Agastache Cusickii* in most respects, but differs in being only 10–15 cm. tall, herbaceous nearly or quite to the base, in having no petioles over about 5 mm. long, and in

being more finely pubescent on the leaves. Although it has been my practice to use the subspecific category for intraspecific units having largely distinct ranges, I hesitate to do so in this case because so little is known about the distribution and range of variation of the plants concerned. I am therefore adopting the term variety.

Agastache Cusickii (Greenm.) Heller var. **typica** nom. nov. *Lophanthus Cusickii* Greenman, Erythea 7: 119. 1899. *Agastache Cusickii* Heller, Muhlenbergia 1: 59. 1904.

Agastache Cusickii (Greenm.) Heller var. **parva** var. nov. Planta 10–15 cm. alta, herbacea fere vel omnino ad basim, petiola ad 5 mm. longa, cetera similis var. typicae.

Type. On limestone outcrop 1 mile southeast of Double Springs summit, 8 miles northeast of Dickey, Custer County, Idaho, at 8600 feet elevation, *3200* (Missouri Botanical Garden; isotypes at University of Minnesota, Utah State Agricultural College and University of Idaho, Southern Branch).

Dr. Palmer Stockwell has recently published a revision of the genus *Chaenactis* (4). In the group surrounding *C. Douglasii* (Hook.) H. & A., he places considerable stress on the duration of the root, character of the caudex, and detailed structure of the pappus. *C. rubricaulis* Rydb., *C. ramosa* Stockwell, and *C. augustifolia* Greene are segregated and allowed to stand on these bases. In dry open places of the Transition and Canadian Life zones of central Idaho grows a perennial branching *Chaenactis* which would key in Stockwell's treatment to *C. ramosa* or *C. rubricaulis*. It is distinctive enough and constant enough to warrant some sort of segregation from typical *C. Douglasii*, but intergrades with the latter so much that it should not be accorded full specific rank and cannot be other than a variety of *Chaenactis Douglasii*. If the pappus characteristics stressed by Stockwell prove constant, it cannot be the same as *C. ramosa*, a plant of central Washington. To *C. rubricaulis*, of southern Oregon and the Sierra Nevada, it seems more similar, differing most noticeably in the pink or pinkish corollas. Also it is less woody at the base, and does not have the "leaves . . . mostly basal-rosulate," as does *C. rubricaulis*. Monographic reconsideration, which is beyond the scope of this paper, may show these differences to be inconsequential, but, in any case, the Idaho plants seem to be clearly a variety of *C. Douglasii*.

Chaenactis Douglasii (Hook.) Hook. & Arn. var. **typica** nom. nov. *Hymenopappus Douglasii* Hook. Fl. Bor. Am. 1: 316. 1834. *Chaenactis Douglasii* Hook. & Arn. Bot. Beechey Voy. 354. 1840.

Chaenactis Douglasii (Hook.) Hook. & Arn. var. **ramosior** var. nov. Planta perennis, in caules ramoses paucos vel plures

divisa quasi ab terrae superficie, corolla et interdum antherae plus minusve rubellae, cetera similis var. typicae.

Perennial, branching at or just below the surface of the ground into several freely branching stems 10–40 cm. high; corollas and sometimes anthers more or less pink-tinged; pappus scales half as long as the corolla; otherwise as the typical variety.

Type. Fine granitic talus along Salmon River, 2 or 3 miles below Stanley, Custer County, Idaho, altitude 6200 feet, July 5, 1941, *2890* (Missouri Botanical Garden; isotypes at University of Idaho, Southern Branch and Utah State Agricultural College).

Cotype. Dry gravelly hillside at Galena summit, Blaine County, altitude 8750 feet, July 31, 1941, *3250*.

Collections number *2695* and *3279*, both from Custer County, are fairly representative, but some specimens are somewhat suggestive of var. *typica*. Collection number *3076*, from a dry gravelly hillside above Willow Creek, 4 miles northeast of Dickey, Custer County, at 7000 feet, differs in lacking the pink tint and being nearly simple at the base, but is strongly branching, and may be regarded as intermediate to var. *typica*.

Some plants which are noteworthy for various reasons, chiefly for not previously having been known to occur in Idaho, are grouped by counties and listed below.

Blaine County: *Bromus japonicus* Thunb. (*3421*); *Stipa californica* Merr. & Davy (*3422*); *Carex scopulorum* Holm (*3641*); *Carex suborbiculata* Mack. (*2644, 2672*); *Saxifraga occidentalis* Wats. (*2592*); *Thlaspi idahoense* Payson (*2585*); *Amelanchier polycarpa* Greene (= *A. glabra* Greene?) (*2596*); *Epilobium obcordatum* Gray (*3729*); *Navarratia divaricata* (Torr.) Greene (*2661*); *Cryptantha echinella* Greene (*3518*); *Aplopappus aberrans* (A. Nels.) Hall (*3769*).

Custer County: *Poa rupicola* Nash (*2990*); *Carex subnigricans* Stacey (!) (*3389, 3413*); *Carex suborbiculata* Mack (*2771*); *Lesquerella Cusickii* Jones (*3178*); *Artemisia annua* L. (*3799*); *Townsendia montana* Jones (*3197*).

Boise County: *Subularia aquatica* L. (*3646*); *Thlaspi idahoense* Payson (*3623*); *Aplopappus Greenei* Gray subsp. *typicus* Hall (*3625*).

University of Minnesota,
Minneapolis, Minnesota,
May, 1942.

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THE LEGITIMACY OF THALICTRUM POLYCARPUM WATS.

Arthur Cronquist

In a recent article in Madroño (7: 1–4. 1943), Croizat maintains that the name *Thalictrum polycarpum* Loret (1859), although illegitimate and not validly published, renders *T. polycarpum* Wats. (1879) illegitimate, as a later homonym. He cites article 61 of the Rules, in part, as follows: "Even if the earlier homonym is illegitimate, or is generally regarded as a synonym on taxonomic grounds, the later homonym must be rejected."

Croizat admits that *T. polycarpum* Loret was not validly published. The part of article 61 which he does not quote, states: "A name of a taxonomic group is illegitimate and must be rejected if it is a later homonym, that is, if it duplicates a name previously and *validly published* for a group of the same rank based on a different type." (Italics mine.) The Rules are clear enough; a name must be validly published if it is to prevent the later use of the same name for a different plant. To further clinch the case, article 19 states: "A name of a taxonomic group has no status under the Rules, and no claim to recognition by botanists, unless it is validly published."

It seems clear that the name *T. polycarpum* Loret, since it was not validly published, cannot illegitimize *T. polycarpum* Wats.

University of Minnesota,
Minneapolis, Minnesota,
February, 1943.

VALID AND LEGITIMATE NAMES—AND THALICTRUM POLYCARPUM S. WATS.

C. A. Weatherby

To devise a set of rules which shall deal adequately with the almost endlessly various nomenclatural situations which exist or may arise is an exceedingly difficult task. It is therefore not surprising that, in the eight years since the publication of the current Rules of Botanical Nomenclature, a number of cases have been brought to light which are not directly covered by the rules or in which the application of the rules is doubtful. It is not an unreasonable hope that, through the exercise of that faculty miscalled *common* sense, through carefully considered discussion of questions actually arising in the course of taxonomic investigation, through decisions by a competent tribunal and cautious amendment of the rules where really necessary, these doubtful points gradually can be made clear. Their solution has not been helped by much of the theoretical discussion of nomenclature for

its own sake published since 1935, especially when it raises illusory difficulties for the bewilderment of the unwary.

Unhappily, Dr. Croizat's discussion of the name of *Thalictrum polycarpum* S. Wats. (Madroño 7: 1–4. 1943), must be classed with those which obscure rather than elucidate their subject. There is no real ambiguity in the use of the terms valid and legitimate and their opposites in the rules. A valid name is one published according to the prescriptions of articles 36 to 45 and otherwise in accordance with the rules (art. 16, note). A valid name is *ipso facto* legitimate; that term, however, is reserved for requirements other than publication. An illegitimate name is one which, though validly published, fails to meet other requirements of the rules (arts. 60 to 69). A fully invalid name is like the last state of the wicked in Buddhist theology—it simply does not exist. Being, for nomenclatural purposes, non-existent, the rules pay no attention to it.

Any confusion which Dr. Croizat detects arises, not from the rules, but from his own unnecessary attempt to redefine the above terms. The first sentence of article 61, the most important for the present question, has entirely eluded him. It reads: "A name of a taxonomic group is illegitimate and must be rejected if it is a *later homonym,* that is if it duplicates a name previously and *validly published* [italics here are mine] for a group of the same rank based on a different type." That is, the earlier homonym must have been validly published in order to bring about rejection of the later one. According to the rule voted at Amsterdam, a provisional name is not validly published; therefore it cannot be a bar to the later independent use of the same name.

The rule as to provisional names was formulated in the course of debate at the Amsterdam Congress, as a substitute for a proposal to outlaw them originally made at the preceding Cambridge Congress and there referred to the Executive Committee (which took no action). As published in the Journal of Botany (74: 75. 1936), it carries no definition of *nomina provisoria* (invalid) and *nomina alternativa* (valid) and no adequate examples.[1] Until it is perfected there may be doubt as to whether a given name is provisional or not. Had Dr. Croizat argued that such doubt existed in regard to Loret's names and that it was therefore safer to employ Greene's name for the Californian *Thalictrum* rather than Watson's, he would have been on firmer, though still highly uncertain, ground and his argument would have been more to the point. For the status of Loret's names is, in the light of article 61, the only consideration of any importance in determining the correct name for the species. If *Thalictrum polycarpum* Loret is provisional, then *T. polycarpum* S. Wats. is the legitimate name

[1] The reference to the original proposal does not help; there the definition was drawn and the examples presumably selected to cover both kinds of names.

and must be used. If *T. polycarpum* Loret is validly published, then *T. polycarpum* Wats. becomes a later homonym and *T. ametrum* Greene (or some other synonym; I do not know the taxonomy) must be taken up.

In view of the imperfect elaboration of the rule as to provisional names, the only safe course seems to be to admit as validly published under it only names which conform closely to the example from de Wildeman given. He had a plant which he unreservedly accepted as a new species, but he was in doubt as to the genus to which he should refer it, and called it both *Cymbopogon Bequaerti* and *Andropogon Bequaerti.* According to the rule, both these names are validly published. But if de Wildeman had written: "I do not feel justified in describing this as a new species; but if I were to do so, I should call it either *Cymbopogon Bequaerti* or *Andropogon Bequaerti*"—that is, if he had not definitely accepted the species[2]—then, as I see it, both names would be provisional and not validly published.

The hypothetical quotation is very near what Loret actually did. On the above basis, then, *T. polycarpum* Loret is a provisional name, not validly published and incapable of functioning as an earlier homonym, and *T. polycarpum* S. Wats. is the correct name for the species.

Gray Herbarium, Harvard University,
February, 1943.

THE ANATOMY OF REDWOOD BARK

Irving H. Isenberg

This paper is one of a series originating from the laboratories of The Institute of Paper Chemistry, Appleton, Wisconsin, and covering a fundamental study of the botanical, chemical and other characteristics of the California redwood; this work has been sponsored by The Pacific Lumber Company, Scotia, California. The present paper is a portion of a botanical study made by the author at the Institute in 1939. Although considerable data have appeared in the literature on the anatomy of the wood of *Sequoia sempervirens* (see J. N. Mitchell, Jour. Forestry 34: 988–93. 1936 for discussion and list of references) the only published work on the anatomy of redwood bark seems to be that included in the article by Abbe and Crafts, who examined the phloem of white pine and other coniferous species (L. B. Abbe and A. S. Crafts, Bot. Gaz. 100: 695–722. 1939). Their studies

[2] On this point—the only definition of a provisional name we have—see Int. Bot. Congress. 1930. Nomenclature. Prop. Brit. Botanists 16 (art. 44); Rec. Synopt. 41 (art. 37 ter).

were apparently confined to the inner bark and stressed maturation of the sieve cells.

The bark of a merchantable redwood tree, *Sequoia sempervirens* (Lambert) Endlicher, is composed of secondary phloem, living and dead, and of periderm. The redwood is a thick-barked tree; the bark is sometimes as much as a foot thick but is usually much less. In external appearance it is reddish, deeply furrowed, and scaly. In transverse section the bark appears as two strikingly different colored rings—the very thin, whitish, inner one and the thicker, reddish-brown, outer one. The light-colored layer, which may have a pinkish tinge, rarely exceeds one quarter of an inch in thickness.

Primary Body

Although the primary bark tissues disappear early in the life of a redwood tree, a brief review of their structure seems to be in order before proceeding to a more detailed study of the secondary phloem. The primary body is self-sufficient and contains all the fundamental tissues and body parts. A cross section of a redwood stem at the end of the first growing season shows (pl. 6) the pith, primary xylem, cambium, primary phloem, cortex, and epidermis, as well as the secondary xylem and phloem. An accessory protective layer, the hypodermis, is located just beneath the epidermal layer. A few longitudinal resin canals are also evident in the cortex in plate 6.

The primary tissues lying outside the cambium are pushed outward by the development of secondary tissues. The increase in circumference to which these tissues must accommodate themselves quickly surpasses their ability to respond, with the result that, sooner or later, they are crushed or ruptured and killed by exposure, and especially by the stoppage of food and water supplies by the cork layers which develop within them. Obviously, the secondary phloem is very important functionally to the tree, because it soon replaces the primary phloem.

Secondary Phloem

The secondary phloem of redwood contains four types of cells—sieve cell, longitudinal parenchyma, fiber, and ray parenchyma (pl. 8).

The sieve cell is the cell characteristic of secondary phloem from the viewpoint both of structure and function. In some specimens of redwood bark examined, the sieve cells comprised the majority of the cells, both in the inner living and in the outer dead bark; in others, there occurred greater amounts of phloem parenchyma. Similar to other gymnosperms, the sieve cell elements are not arranged in series, end to end, forming definite conducting lines, but are separate and distinct. The sieve plates are scattered irregularly on the radial walls of the sieve cell ele-



PLATE 6. SEQUOIA SEMPERVIRENS. Cross section of one year old stem. × 3



PLATE 7. SEQUOIA SEMPERVIRENS. Cross section of inner and small part of outer bark. ×20. A, last-formed periderm; B, dilated phloem parenchyma; C, cambium; D, "reinforced" area.

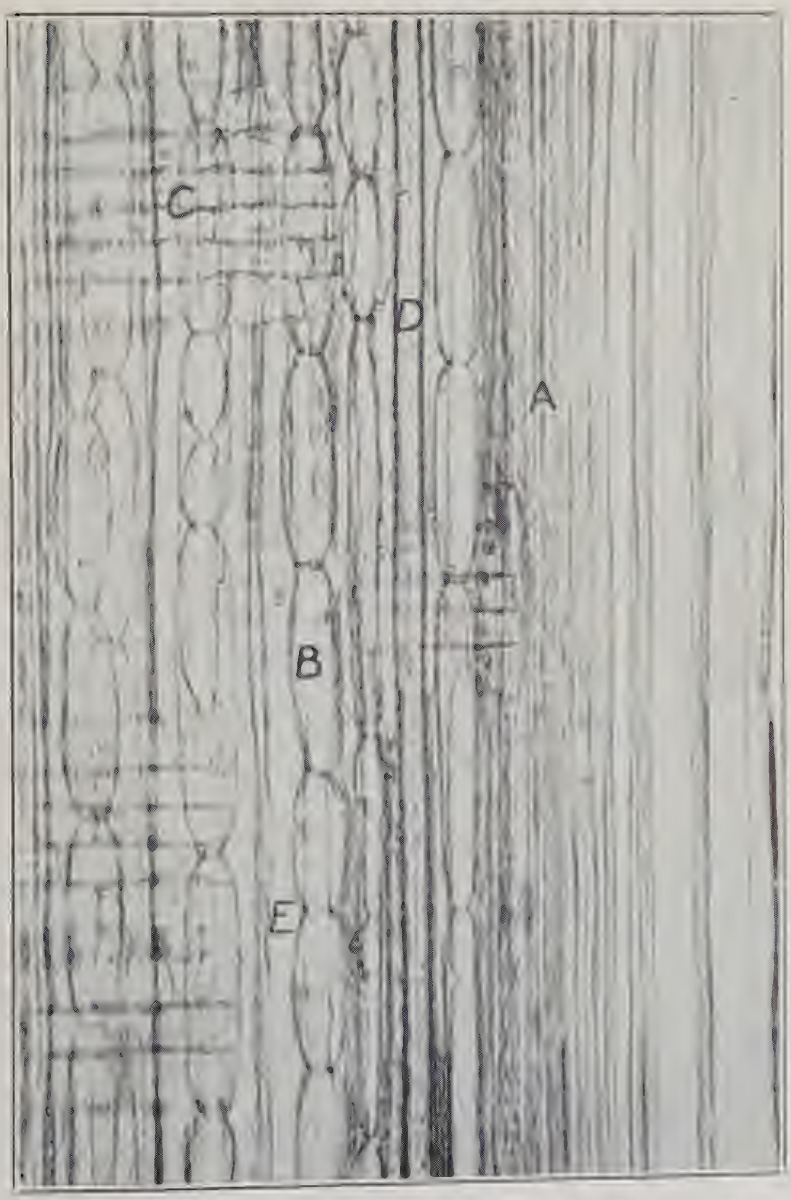


PLATE 8. SEQUOIA SEMPERVIRENS. Radial section of inner bark and sapwood. ×200. A, cambium; B, phloem parenchyma; C, ray; D, fiber; E, sieve cell.

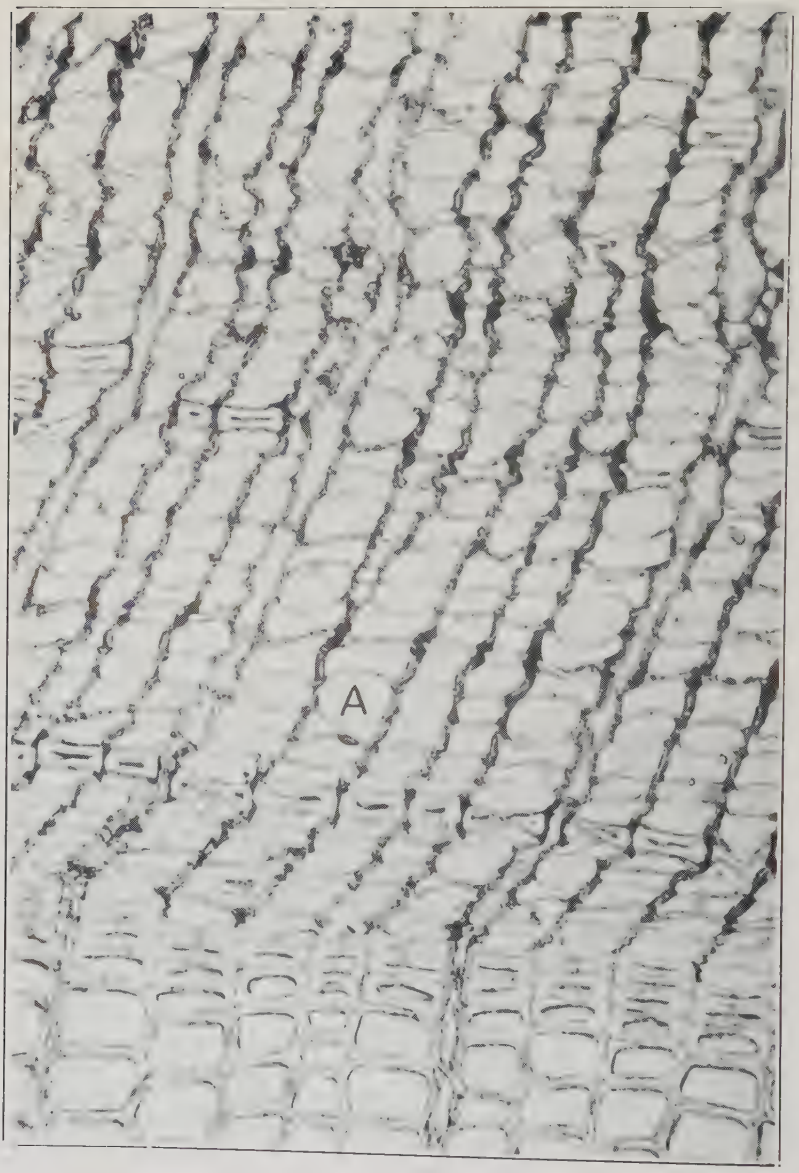


PLATE 9. SEQUOIA SEMPERVIRENS. Cross section of inner bark. ×200. A, phloem parenchyma.

ment; their diameter is only slightly less than that of the sieve cell. Painstaking work by Abbe and Crafts has revealed many interesting details in the living sieve cells in *Sequoia sempervirens* and other coniferous species, especially *Pinus strobus*.

The phloem parenchyma cells are rectangular, or more or less rounded, in cross section because of bulging tangential walls (pl. 9, A), with the larger dimension tangential. The height of the cell is several times greater than either transverse dimension. When the parenchyma cells appear rectangular in transverse section, it is impossible to distinguish them from sieve cells. It is very easy, of course, to separate parenchyma and sieve cells in either longitudinal plane because of their great difference in length and also because of the presence of sieve plates in the walls of the latter. The average length of phloem parenchyma cells is 180 microns, ranging from 110 to 300 microns.

The phloem fibers are arranged in tangential uniseriate rows which occur rather regularly (pl. 10). These fibers are of economic interest. However, although the bark of the redwood tree is termed fibrous, it does not, unfortunately, contain a very large percentage of fibers by weight. The frequency of formation of these uniseriate rows of fibers cannot be determined in older sections of bark because of the formation of periderm and the sloughing of outer dead bark. Examination of several smaller stems suggests that approximately one row of phloem fibers is formed each year, at least during the first ten years. Later they appear to be formed less frequently. It seems more probable, however, that the number of rows and the dimensions of the fibers are dependent upon environmental factors. The average length of more than 300 fibers was 6.73 mm., ranging from 3.0 to 9.6 mm., with a standard deviation of $\pm$ 0.14 mm. The average tangential diameter was 46 microns and the average radial diameter was 18 microns. As might be expected, the individual data covered a much greater range in radial than in tangential dimension. The fibers have a very thick wall and a slit-like lumen. Simple pits occur on the radial walls.

The phloem ray consists entirely of parenchyma cells. These rays are usually uniseriate, although not infrequently some biseriate rays occur. In height they varied from one to many (about 27) cells, or approximately 700 microns. The average length of the ray cell was 130 microns, ranging from 80 to 250 microns. There were approximately four rays per millimeter tangentially, as measured on the cross section. Abbe and Crafts have reported relatively fewer albuminous cells in the phloem rays of redwood than in white pine. In the present study short rows of erect marginal cells were found very close to the cambium in a few of the phloem rays.

The tissues of the secondary phloem of redwood appear to be arranged in definite tangential bands (pl. 7), as a result of

the rather regular occurrence of the fibers in tangential uniseriate rows. However, these ring-like bands do not have definite seasonal limits as do those of the secondary xylem, because there is no distinction between the phloem cells formed in the early spring and those of the late summer comparable to the difference between springwood and summerwood.

Periderm

The last-formed periderm is located at the boundary of the inner living bark and the outer dead bark (pls. 7, 10, and 16). Only a few rows of cork cells are formed by the phellogen. There are an approximately equal number of phelloderm cells formed. The cells constituting the phellem, commonly known as cork cells, are uniform in shape; in this respect they resemble the cork cambium cells from which they originated (pls. 12, B, and 13, B). The cork cell is filled, at least partially, with a dark reddish-brown alkali-soluble material designated as acid-lignin; this material also occurs within the ray cells of the outer bark but otherwise appears to be deposited as a thin coating on the walls of cells in the outer dead bark. The mature cork cells are nonliving and usually without pits. Phelloderm cells are living and are arranged in definite radial rows (pls. 12, C, and 13, C). A phellogen in the redwood tree functions for only a brief period of time; its component cells then mature to form one of the derived cells, but they do not necessarily have colored contents. The formation of each periderm layer shuts off all outer tissues from the food and water supply; thus, soon after the initiation of a layer, all outer tissues die. Lenticels occur in the periderm layers of redwood bark just as they do in the barks of other species.

Variation in the Bark

In order to study variation in bark structure, microsections from many sources were examined but most attention was given to a piece of bark about 7 inches thick. Small blocks were taken at the boundary of the inner and outer bark, and in the outer bark at points which were 1.5, 3, 4, 5, and 6.5 inches from the cambium. Because of the brittleness of the outer bark, it was necessary to embed the samples in celloidin before sections could be cut. Unfortunately, even this preparation did not prevent tears so that perfect, untorn sections were not obtainable.

A study of the microsections revealed a marked structural difference between the inner bark and the outer bark (pls. 9, 10, 14, and 16) but little variation among parts of the outer bark in this series (pls. 15 and 17 are representative). The most noticeable of these differences between the inner and outer bark are:



PLATE 10. SEQUOIA SEMPERVIRENS. Cross section of inner and outer bark boundary. ×200. A, ray.

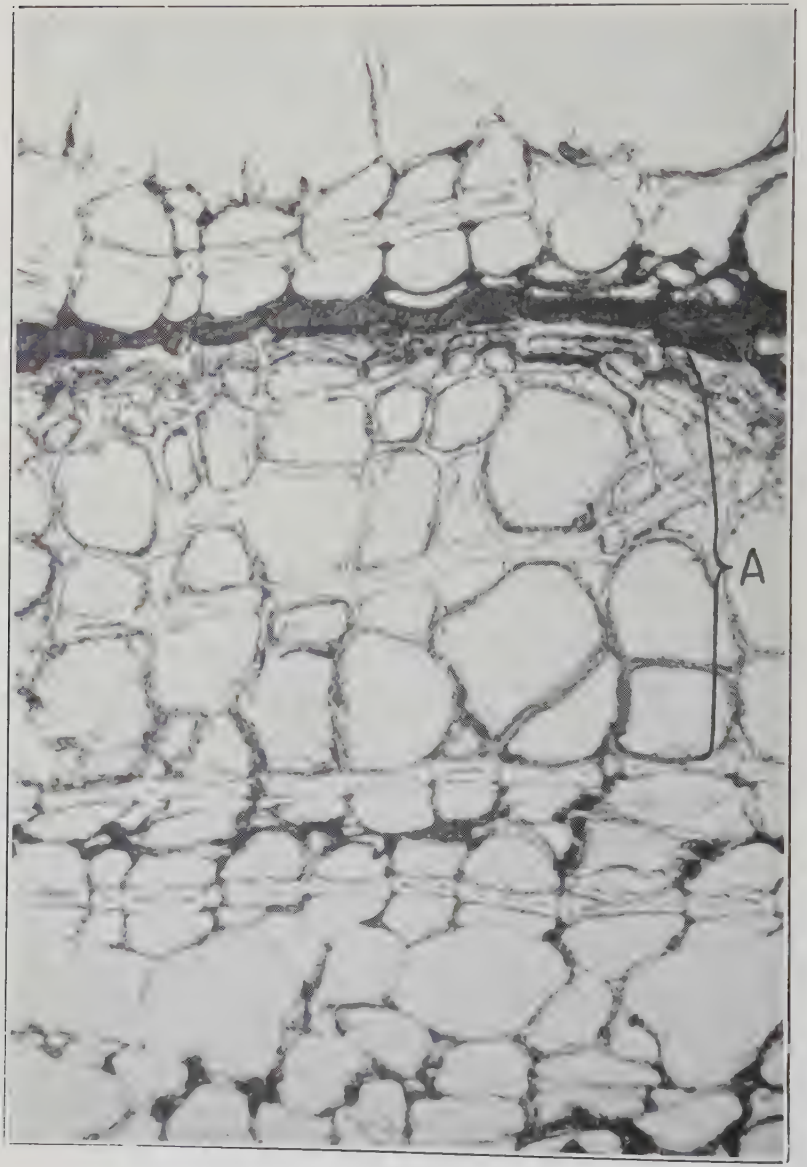


PLATE 11. SEQUOIA SEMPERVIRENS. Cross section of "reinforced" area in outer bark. ×200. A, "reinforced" area.

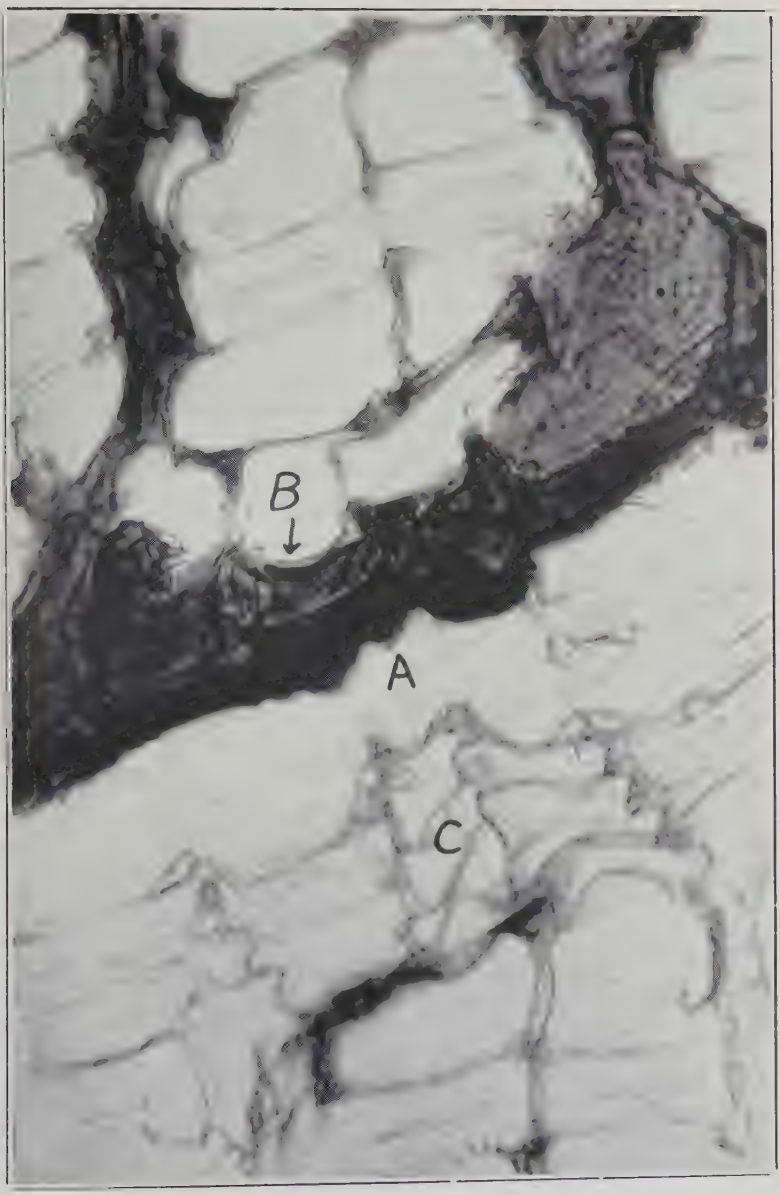


PLATE 12. SEQUOIA SEMPERVIRENS. Cross section of last-formed periderm. ×500. A, phellogen; B, phellem; C, phelloderm.

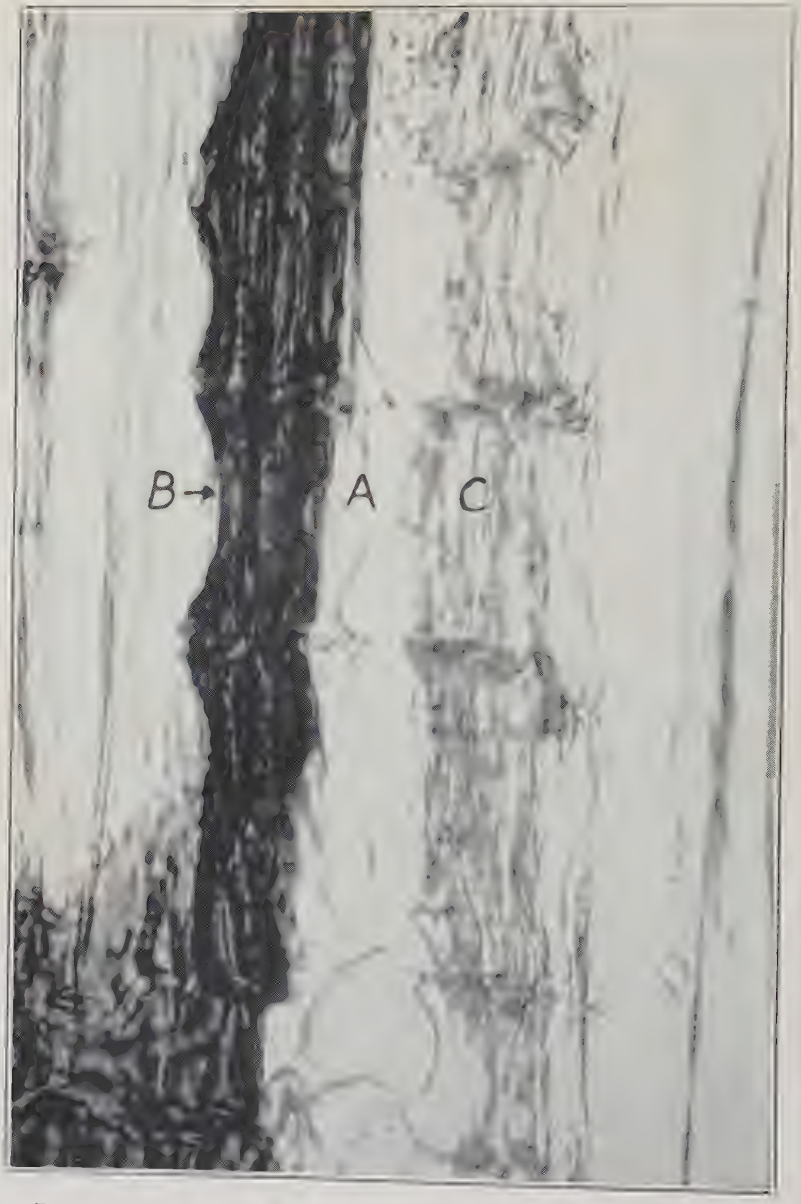


PLATE 13. SEQUOIA SEMPERVIRENS. Radial section of last-formed periderm. ×500. A, phellogen; B, phellem; C, phelloderm.

(1) the swelling of some of the ray parenchyma cells (pl. 10), with occasional increase in the number of cells in the width of the rays; (2) the increase in radial diameter of some of the phloem parenchyma cells (pls. 14, A, and 16, A); (3) the formation of "reinforced" areas of the thicker-walled parenchyma cells inside the periderm of outer bark (pls. 14, B, and 16, B); and (4) the presence of old periderms (pl. 18).

The lateral expansion of the ray cells may be due to the fact that they probably remain alive until the most recent periderm completely seals off the shell, thus forcing back some of the thin-walled longitudinal cells. It can be seen in many of the photomicrographs (e.g., pl. 10) that, where the ray cells are in contact with the thick-walled fibers, they do not dilate. The increase in the width in cells of the phloem ray may be due to the need for peripheral expansion when the stem increases its diameter. Such an increase may also occur in the outer part of the inner bark.

Not all phloem parenchyma cells show an increase in radial diameter, nor do all the specimens exhibit this phenomenon (e.g., pl. 18). The cause of this dilation is unknown. It may be a response to excessive increase in the circumference of the stem, or perhaps it is a mechanism for abscission of the old bark.

The so-called "reinforced" areas of thick-walled cells, found frequently internally adjacent to the phellogen in the outer bark, are not present in all specimens of redwood bark, nor are they located regularly in the same cross section of bark. There does appear to be a relationship between the dilated phloem parenchyma cells and the thicker-walled cells of these "reinforced" areas, because both phenomena are usually found close together (compare pls. 7, 14, 16, and 18).

The cells of these "reinforced" areas appear to be phloem parenchyma cells, which have dilated somewhat and thickened their walls. The walls of these cells, although thicker than those of the sieve tubes and phloem parenchyma, are not as thick as those of the phloem fibers (pl. 11). When treated with 72 per cent sulfuric acid, these walls appear to swell.

The location of these cells suggests phelloderm, although several facts refute this, namely: (1) they are not of universal occurrence in redwood bark and, even in the sections where they do occur, their distribution and amount are not uniform; (2) usually there are many more cells than normally occur in redwood phelloderm; (3) they are not found inside the most recent phellogen layer; (4) uniseriate rows of phloem fibers are located within these "reinforced" areas; and (5) close examination reveals crushed and torn fragments of sieve tubes clinging to the phloem fibers. The exact classification of these cells is difficult, but they appear to be a modified parenchyma cell.

The phloem fibers develop a short distance from the cambium (pl. 9), and the tangential uniseriate rows are spaced rather

evenly throughout the bark with from two to five rows of cells between the rows of fibers (pls. 10 and 18). Considerable variation is evident, but usually a row of sieve tubes is found on each side of the fiber with a row of phloem parenchyma between the sieve tubes (pl. 16). This same standard pattern has been reported in the secondary phloem of redwood and incense cedar by Abbe and Crafts.

Fiber length measurements were made at various distances from the cambium. The following values, each representing an average of 30 measurements, were obtained: inner bark, 7.1 mm.; outer bark (1.5 in.[1]), 6.8 mm.; outer bark (3 in.), 6.6 mm.; outer bark (4 in.), 6.6 mm.; outer bark (5 in.), 6.4 mm.; and outer bark (6.5 in.), 6.65 mm. These measurements were made on unbroken fibers isolated by the nitric acid-potassium chlorate maceration method. From the data, it must be concluded that there is no significant difference in length of fibers with increased distance from the cambium.

Calculations were made to determine the relative volume which the phloem fibers occupy in the bark. The following values were obtained: inner bark, 18.7 per cent; outer bark (0.25 in.[1]), 5.6 per cent; outer bark (1.5 in.), 6.7 per cent; outer bark (3 in.), 4.8 per cent; outer bark (4 in.), 5.9 per cent; and outer bark (5.25 in.), 4.9 per cent. The greatest difference is obviously between the inner bark and the outer bark, and is undoubtedly due to an increased radial diameter of some of the phloem parenchyma. A specimen of outer bark (a short distance from the inner bark), which showed no dilation, had 10.9 per cent fiber, whereas the adjacent inner bark had only 12.0 per cent as compared with 18.7 per cent previously observed for inner bark. These values are all based on volume. One might expect the percentages by weight to be higher but to show little variation in the outer bark. The calculation of weight percentages is complicated by the deposition of extraneous matter and parenchyma cell expansion. The volume difference between the inner bark and outer bark might disappear on a weight basis, as the weight of extraneous material might balance increased air space caused by cell expansion. No weight percentages were attempted.

Microchemistry

The striking difference in color between the outer and inner bark of redwood is the result of the deposition of a reddish-brown substance. Although this coloring matter is conspicuous in the ray cells and the cells of the periderm, it is deposited on all cell walls. Microchemical tests were made to determine the nature of this material. It was found that the color could not be removed by a three-hour extraction with hot alcohol on a steam

[1] Distance from the cambium layer.



PLATE 14. SEQUOIA SEMPERVIRENS. Radial section of outer and small part of inner bark. ×30. A, dilated phloem parenchyma; B, "reinforced" area.

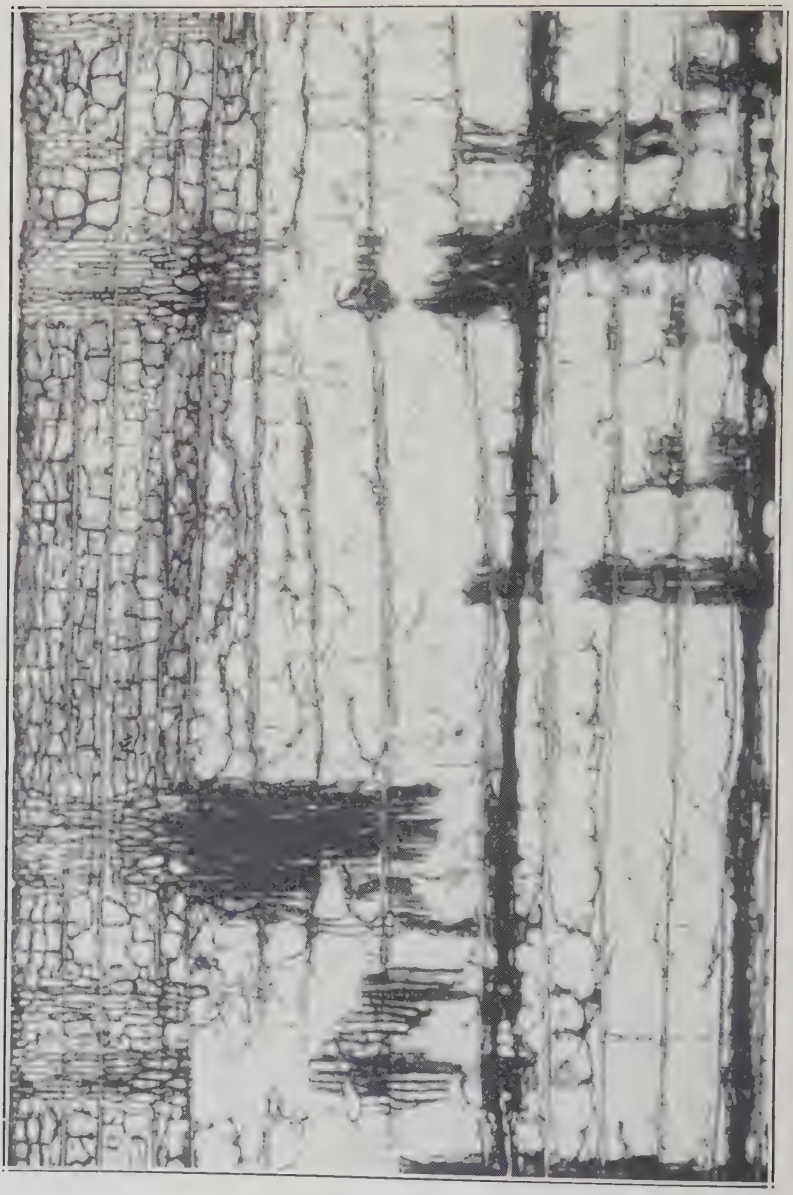


PLATE 15. SEQUOIA SEMPERVIRENS. Radial section of outer bark, 1.5 inches from the cambium. ×30.

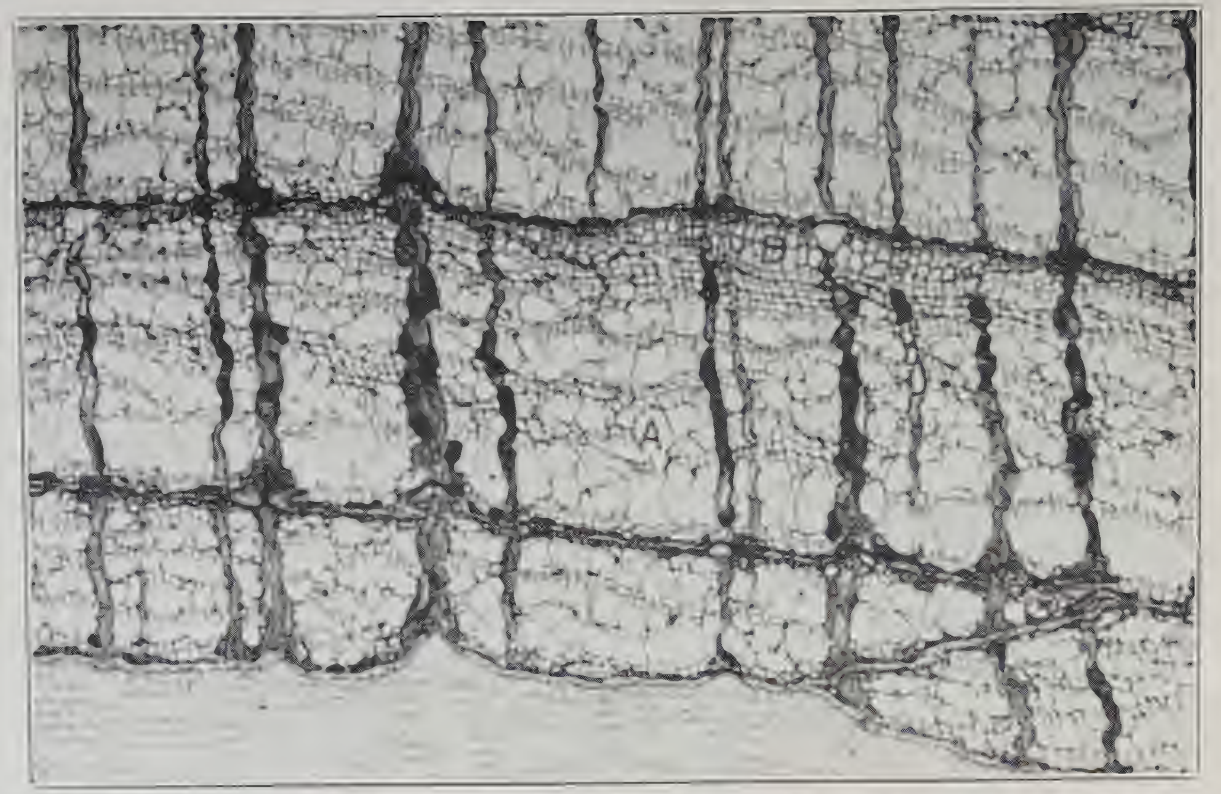


PLATE 16. *SWIETENIA SENEGALENSIS*. Cross section of outer and small part of inner bark. × 26. A, dilated phloem parenchyma; B, "reinforced" area

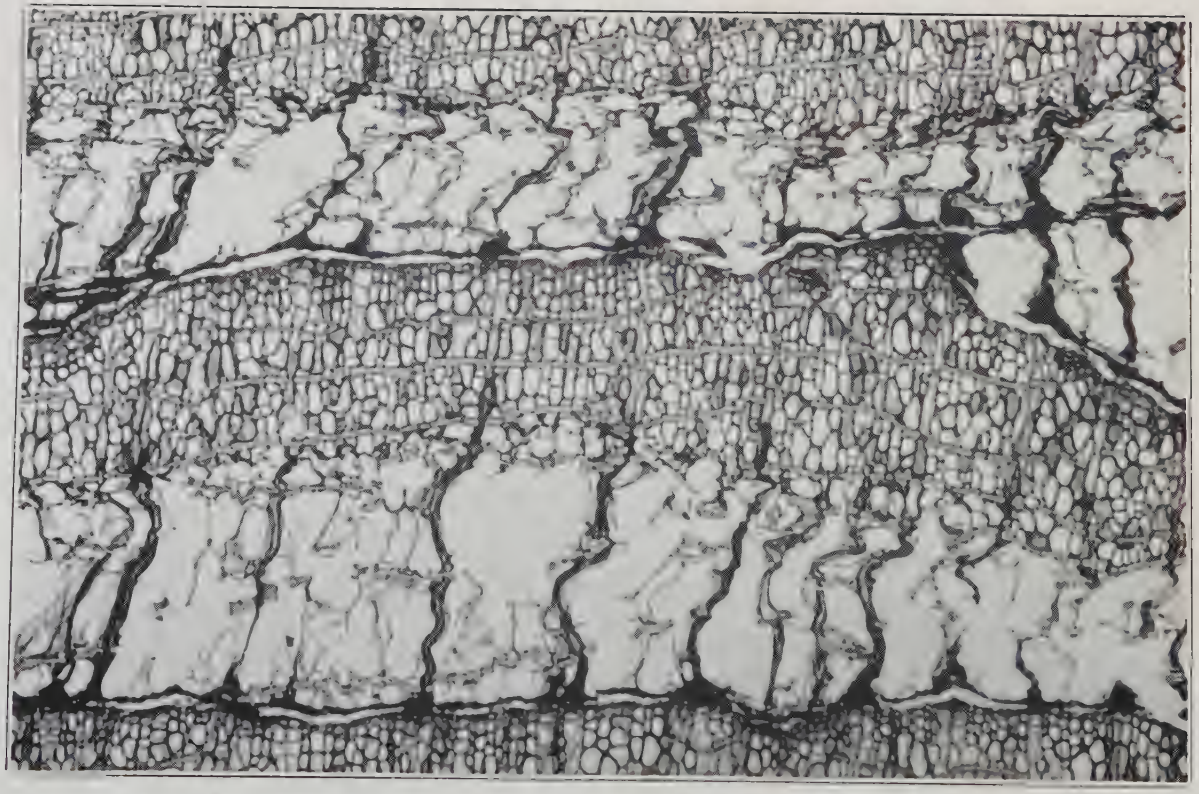


PLATE 17. SEQUOIA SEMPERVIRENS. Cross section of outer bark, five inches from the cambium. ×30



PLATE 18. SEQUOIA SEMPERVIRENS. Cross section of outer bark. ×30.

bath or by a five-hour extraction with hot acidulated alcohol (3 per cent glacial acetic acid) on a steam bath. Treatment of the sections with 72 per cent sulfuric acid caused the yellow-colored phloem fibers to turn green and swell, eventually turning lavender but remaining as large balloon-like bodies and dissolving only partially. The contact with concentrated acid darkens the reddish-brown deposit in the ray cells and periderm cells, but otherwise it is not visibly affected. Thus, in a lignin determination this material would be insoluble and, hence, would be determined as lignin. Extraction with cold 1 per cent NaOH for several days removes a considerable portion of the coloring matter; the same effect can be obtained within a few hours by extraction on a steam bath. If the yellow-colored section remaining after alkali extraction is treated with 72 per cent sulfuric acid, much of the structure disappears; however, the fibers, although greatly swollen, remain intact. The fibers are largely cellulose, but contain some lignin, as well as a small amount of coloring matter. An extended discussion of the chemical composition of redwood bark will appear in a further publication.

The Institute of Paper Chemistry,
Appleton, Wisconsin,
May, 1943.

WILLIAM ALBERT SETCHELL

With the death of William Albert Setchell the botanical profession mourns the loss not only of a great algologist but also of one of its outstanding personalities and of a great and effective humanitarian. The details of his life have been amply treated by others (Goodspeed, T. H., William Albert Setchell, in Essays in Geobotany in Honor of William Albert Setchell, University of California Press, Berkeley, 1936). It will suffice here to state that he was born on April 15, 1864, was educated at Yale and at Harvard where he was a fellow and a student of Farlow. Subsequently he served as Assistant Professor at Yale and in 1895 came to the University of California as Professor of Botany retiring as Professor Emeritus in 1935. He died at his home in Berkeley, California, on April 5, 1943, just a few days before his seventy-ninth birthday.

A voluminous bibliography attests his activity in the field of algology. Much of this work was done in cooperation with the late Dr. Nathaniel Lyon Gardner with whom he built up one of the outstanding algological herbaria and libraries of the world, now deposited at the University of California at Berkeley. Together they attempted to complete a comprehensive treatment of the marine algae of the Pacific Coast of North America, of which all but that dealing with the red algae has been published. The

latter was left largely in rough manuscript form. His interests, however, encompassed much more than the algae. His writings and those of his students involve the fungi, bryophytes and some of the flowering plants as well. It was Setchell who initiated and inspired the investigations on tobacco so ably furthered by Clausen, Goodspeed, and the late Dr. Priscilla Avery.

He travelled widely over the world and collected much from diverse sources, bringing home not only specimens which are deposited in the Herbarium of the University of California, but vivid accounts of unusual plants, botanists, fellow travellers and an infinite number of personal anecdotes that delighted all who were fortunate enough to hear him.

To the perennial stream of students that flow through a large university he was a source of inspiration and wise counsel. The needy student was one of his primary concerns; he gave freely of his time and resources—often financing the entire cost for students who became ill and required hospitalization. Sometimes this was accomplished anonymously and at other times directly. When repayment was offered he would reply, "You had better keep it so that you may be able to do the same for somebody else." The gifted student was his special delight. He enjoyed provoking him into argument and never lost an opportunity to trip him. If he could lead him into making a rash statement, the student was never permitted to forget it. Until the day of his death, Professor Setchell was continually surrounded by youth to whom he was a genial host and for whose entertainment he provided the best in music and literature and always a subject for argument. He spoke of these associates as his "nephews" and a few "nieces"; they are to be found the world over and are of several races. All of them knew him fondly as "Uncle Bill" and all of them know each other, if not personally, at least by their reputation as to their ability to argue.

Professor Setchell loved words; he was at his best in an argument with strong opposition where he would let loose such a flow of brilliant terminology that his opponent was often baffled. Once an eminent geologist came in and settled in a chair, utterly exhausted. He remarked, "I have just come from an argument with Setchell. We were discussing the origin and structure of atolls. So long as he used words that I understood I had the better of the argument. Soon, however, he began using words that I had never heard before, presumably terms in my own field. I simply had to back out!" In most commonplace discussions Setchell would make free use of Greek or Latin, or perhaps he could express his idea better with a German word or a chance Maori term picked up in his travels. They were all in his vocabulary ready to be used where they would be most effective.

In teaching he had developed the technique of the showman



Plate 19. William Albert Setchell, 1936.

and his lectures in plant geography, especially those dealing with plant dispersal and dispersal mechanisms, were replete with demonstrations that were both highly instructive and entertaining. He had gathered great quantities of material for these lectures during his world travels. The lecture room was always adorned with large poster-like charts, illustrations or maps all attractively done in color. His lectures were rich in anecdotes of personal experiences vividly told. He was especially fond of giving a ludicrous account of himself—a large man with umbrella in hand being carried through the forest by diminutive natives, all the while booming out instructions to the native collectors as to what to collect and how to prepare it. Needless to say his lectures were always well attended.

He was a man of outstanding personality and had the habit of speaking his mind honestly, freely, and richly. Naturally there were those who found this uncomfortable. There was no room in his heart for picayunishness, personal animosity, disloyalty or intrigue; however, he suffered deeply but forgivingly of these traits in the hearts of others.

During the forty-eight years that Dr. Setchell was associated with the University of California, he saw and helped it develop from a young western school to one of the great state universities of this country. He was active in the life of the University and was one of its important figures. In 1931 his colleagues honored him with the Faculty Research Lectureship. With his death, students and associates have lost another of the contacts with classicists of the past.—Herbert L. Mason.

REVIEWS

Studies of Evaporation and Transpiration Under Controlled Conditions. By Emmett Martin. Carnegie Institution, Washington, Publ. 550. Pp. 1–48. 1943. Printed by offset.

The phenomenon of transpiration has justly commanded the attention of botanists, many of whom have attempted to get an index which would be useful in judging the habitat. The author of this work has carefully measured the transpirational loss of water from *Helianthus* and from *Ambrosia* for the purpose of determining its correspondence with evaporation from imbibed nonliving surfaces. Many of his experiments employed small potted plants in special chambers though certain out-door comparisons were made at Santa Barbara, California, and at or near Colorado Springs, Colorado.

The resistance of the plant to water losses was more than once demonstrated by the work. For example, the relation between the rate of transpiration and relative humidity was approximately linear for young plants, but the rates of transpiration of older

plants were less than for younger ones at temperatures of 27° and 38° C.; though age seemed to make no difference at 49° C. Apparently the author overlooked the careful work on age and transpirational losses conducted by Bartholomew.

Records obtained from inserted thermocouples showed that a leaf exposed to radiation equivalent to that of noon sunlight may still maintain an internal temperature lower than that of the surrounding air. Transpiration reduced the temperature of the leaves 10° C. or less. At higher leaf temperatures the depression of the temperature of the leaf below the air decreased, probably due to the increased permeability of the cuticle and epidermal cell walls to water.

The regulatory power of stomata of *Helianthus* decreased as the air temperatures went up from 27° to 49° C. as shown by an increase in the ratios of night-time to daytime transpiration rates though the possibility of injury at 49° C. appears to have been disregarded.—H. S. Reed, Department of Botany, University of California, Berkeley.

Systematics and the Origin of Species from the Viewpoint of a Zoologist. By Ernst Mayr. Pp. xiv + 334. Columbia University Press, New York. 1942. $4.00.

This important work might better have been entitled "The Origin of Species [Microevolution] and [the Application of this Concept to] Systematics," for one does not have to read many pages before he discovers that traditional descriptive systematics has contributed very little to the discussion aside from the mechanics of nomenclature. The subject is approached from the broad viewpoint of a general biologist who not only understands the principles of genetics, ecology, morphology, physiology, and geographical distribution, but who is able to apply these to the problems of systematics. The result is a sound and pleasing philosophy of the nature of systematic units which seems to meet the requirements of the evidence from each of these diverse approaches.

As a specialist in one of the most highly developed branches of systematic biology (ornithology), Dr. Mayr is eminently well qualified to write on the subject of the origin of species and systematics. The biological array is so vast that it is only by the intensive study of a limited group that one may gain an insight into the forces which must govern the entire assemblage of groups. With a worldwide representation of only 8500 species (comparable in number to the "good" species of angiosperms indigenous to the western United States, but incomparably better known), the birds offer unusually favorable material for the formulation of biological principles. The systematic botanist may find many of Dr. Mayr's illustrative examples unfamiliar, but often he will be

able to supply similar examples from his experience with plant species.

Dr. Mayr conceives a species as a dynamic unit. "Species are groups of actually or potentially interbreeding natural populations, which are reproductively isolated from other such groups [p. 120]." As such, the species is a natural and an evolutionary unit, but it is not necessarily morphologically uniform. As a matter of fact, morphological uniformity is not a characteristic of most such species. The acceptance of this concept of polytypic species disposes of a difficulty against which cataloging systematists have been struggling for years. Whether each distinguishable geographical variant should be described and named as a subspecies (even if only 75 per cent of its individuals are determinable!) as is the practice of the ornithologist, or nomenclatorially ignored as is the preference of most systematic botanists is a question upon which there will continue to be diversity of opinion. The recognition of named geographical subspecies by the ornithologist is a compromise between the "lumpers" and the "splitters" among the taxonomists of the morphological school. To impose this compromise on groups which have never been split consistently into the smallest elements which could be distinguished even part of the time would not in the opinion of the reviewer simplify the classification of those groups. It may be sufficient to understand that most biological species do vary geographically.

The suggestion that the microgeographic races (jordanons) among plants do not have an exact homologue among animals is probably incorrect. This error possibly is due to a failure to realize the total magnitude of the barrier to free interbreeding imposed by immotility and habitat requirements. Microgeographic races among plants are the expression of genetic isolation of the same magnitude and sampling errors of the same kind as result in geographical subspecies among animals. They are equally distinct. If Dr. Mayr's criterion of a geographical subspecies is that it be regional rather than local, he may find such phenomena among those plants which have overcome the barrier of distance through the development of wind pollination or of highly effective mechanisms of seed dispersal.

Although he defines a species as consisting of "actually or potentially interbreeding natural populations," Dr. Mayr points out that many unquestionably distinct species are able to interbreed when brought together experimentally. Barriers which ordinarily would prevent interbreeding are often ineffective under artificial conditions. The important point is not whether two entities can interbreed or not, but whether or not they actually have done so in nature to the extent that their distinctive characteristics have become obscure. The existence of natural hybridization between species and even genera is freely admitted,

and criteria for the recognition of such secondary intergradation between distinct entities are clearly presented.

Genera are believed to be natural and monophyletic groups of species, although the exact size and content of a particular genus must necessarily be governed by taxonomic convenience and the preference of the individual systematist. Thus, unlike species, genera in different groups may not necessarily be comparable units. Among the birds, for instance, there are recognized at the present time some 2600 genera which average 3.27 species each. Dr. Mayr would consider "an average of 5 species per genus . . . definitely preferable to the present ratio." Genera of this small size would scarcely be advocated by the most extreme "splitters" among the plant taxonomists. Higher categories are admitted to be even more subjective.

Few thinking systematists would seriously question the validity of Dr. Mayr's principal generalizations. For the most part, very wisely, he has left their application in groups with which he is not familiar to specialists in those fields. As has been pointed out, there seems to be little occasion at the present time to apply the concept of polytypic species to the nomenclature of plant species, at least not to the same extent to which it has been found useful among the birds. This is particularly true in the genus *Calochortus* with which this reviewer is most familiar. Here, contrary to Dr. Mayr's suggestion, each of the species groups (subsections) is not comparable to a polytypic species, but to many an avian genus! The vast majority of the species of *Calochortus* are polytypic, so much so that the consistent description and naming of geographic subspecies would burden the nomenclature of this genus with hundreds of cumbersome trinomials. Such certainly would confuse, not simplify, the existing situation.

The appearance of Dr. Mayr's lucid and stimulating book marks an important point in the development of a sane and comprehensible biological classification. It is a fitting companion volume to Dobzhansky's "Genetics and the Origin of Species," and like that work should be read and understood by every individual who would be called a systematist.—Marion Ownbey, State College of Washington.